THE INJURIES INCIDENTAL TO ATHLETIC EXERCISES CONSIDERED AS TO THEIR CAUSATION, PATHOLOGY AND RATIONAL TREATMENT.

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INTRODUCTORY.

Perhaps at no period in our Nation's history has the pursuit of athletics been more popular that at the present. Nor is the practice confined to any particular class of society. For the peasant boy who plays at cricket of football on the village green and for the nobleman who enters into a polo competition at Hurlingham the spirit of keenness is the same. The competitive idea pervades all ranks. At the public schools athletics enter largely into the daily life, for each boy is expected and encouraged to take part in the games; and at the old Universities the average undergraduate, even if he is not a competitor himself, treats the true athlete or "blue" with as much respect as he does the scholar, and in some instances with even more. It is not surprising, therefore, considering the many thousands who are daily engaged in these pleasant yet serious pastimes, that various accidents and injuries are from time to time met with amongst those so employed.

It is with these injuries, unavoidable as they would seem to be, that the writer of this thesis is concerned. He would enquire especially into the causation of these accidents to discover some means

whereby they may in some measure be prevented or minimised; and failing prevention, he would discuss the remedial measures most helpful to early and complete restoration to functional activity. All such methods of treatment to be efficacious must be at the same time rational, and systematically carried out, and be dependent entirely upon a full knowledge of the exact pathology. That many of the means employed in the past have been empirical no one will gainsay, any more than it can be denied that in certain directions there is still room for improvement. An attempt will be made in the succeeding chapters to introduce into the discussion the opinions held by the opposite schools with a view to criticism in so far as they are for or against the method adopted by the writer.

For the last 14 years it has been his privilege to be professionally connected with many of the athletes injured at one of the old Universities in England and with those at a large public school for boys. Ample opportunities have been afforded him for not only seeing many of the well known injuries that have been recorded and of dealing with them soon after their occurrence, but also of meeting with others seldom if ever to be found mentioned in current literature.

While many of the injuries are the result of direct violence such as from blows or falls, the vast majority are occasioned by indirect violence such as strains. For the convenience of classification the

injuries may be divided into (a) those in which there is an open wound in the skin and (b) those without a wound; or again into those affecting (1) the various viscera or internal organs, (brain, spinal cord, abdominal organs), and (2) those concerned with the various connective tissues of the body, such as the nerves, bones, muscles, ligaments, subcutaneous tissues, vessels etc.

Injuries to the viscera are fortunately, uncommon, while those affecting the various connective tissues are of everyday occurrence. Yet, relatively to the enormous number of players, it may be stated generally that accidents are not as frequent as one would be inclined to think at first. Exact statistics however, are wanting.

Almost every organ or tissue in the body is liable to injury. The extent of the particular injury varies with the amount and nature of the violence. Thus a slight violence may be productive of a minor injury (contusion) when applied to one of the ordinary tissues of the body, yet may give rise to disastrous consequences (large haemorrhage) when applied to one of the more delicate internal organs.

Perhaps of the various games, football may be said to be the most fertile in injuries, and the reason for this probably in a measure lies in its almost universal popularity. While the Rugby game accounts for the greater number of accidents, that played under

the Association rules perhaps occasions the more serious injuries. But even these are less grave than the mishaps that may occur in the hunting field or in point-to-point races, or in the game of polo. Injuries of every degree may be met with from the slightest bruising of the skin to the fractured skull or injured spine.

II.

MASSAGE AND MOVEMENTS.

Massage and movements have from time immemorial been employed as surgical methods, but in recent years they have come more and more into vogue. Both are valuable means of treatment and are often required.

Nevertheless, as surgical methods, they should be chiefly reserved for the use of the surgeon and practised under his immediate control and direction. It should be his province carefully to select the cases for their employment, to regulate the duration of each sitting, and to note the effect produced. Unless some such precaution is taken, much harm may result from indiscriminate rubbings and movements. Constitutional affections such as gout or subacute rheumatism are not infrequently lit up by "bonesetters" and others who rub and move everything. Contusions in which there has been much extravasation of blood are occasionally rendered more severe by massage applied at too early a date; the friction increasing the amount of the bleeding into the tissues.

Cases are not unknown where a tubercular joint has been daily moved and rubbed for weeks, or as long as the patient would submit to it, under the impression that it was an old sprain or injury.

At this stage it may be well to inquire into the ways in which massage acts on the various tissues. It influences materially the general nutrition of all the tissues by increasing the blood supply, and by hurrying on the circulation through them, so that in

a given time more oxygen than usual is brought to the part and local combustion is increased. This may be exemplified by the redness of the skin which readily follows upon rubbing, and the feeling of local warmth engendered in a limb which has been previously cold and pale.

Brunton and Turnicliffe demonstrated experimentally that the flow of blood through muscles that were massaged was increased both at the time and immediately afterwards. This fact would readily explain the restoration of function in muscles that have been damaged.

The essential principles of massage in chronic inflammations are to break up mechanically the extravasated products and to promote the absorption of the broken up material by the lymphatics. The mildest form is "friction massage", by which from rubbing in a circular manner with the fingers the exudation is broken up. Then by gently stroking in the upward direction, termed "effleurage", the material is passed on to and taken away by the healthy lymphatics and veins. The effect upon damaged muscles is that of an excitant or stimulant acting through the nervous system. In contusions and sprains the nerves are likely to be pressed upon by the extravasations and for a time rendered functionless. An everyday experience is that of numbness occasioned in a dependent or strangulated limb by ~~improved~~ impaired circulation. To a much greater extent is this to be found where the tissues are oedematous from effusion caused by injury or disease.

This loss of sensation is readily restored by gentle friction. Muscular spasm and pain occasioned by a fracture are undoubtedly diminished by the gentle and judicious employment of "Effleurage".

Adhesions in joints, and between tendons and their sheaths, as well as between muscles and fractured bones, if not too firm or of too long standing, are removed by massage. In the large majority of cases the above-mentioned forms of "friction-massage" and "effleurage" will be amply sufficient. In the more copious effusions and in long standing cases, where the material is tougher, it may be necessary to employ kneading ("petrissage") or tapping, the "tapotement" of the French. Thus the therapetic value of these mechanical methods is incalculable when athletic injuries are to be treated.

MOVEMENTS in reference to injured joints.

(1) Passive with an anaesthetic, (2) passive without an anaesthetic, (3) active.

Passive movement with an anaesthetic is employed in severe and painful injuries to joints where it is necessary to make a definite diagnosis, or to replace a displaced inter-articular cartilage, or to restore an articulation to its proper angle from a faulty position in which it may have become fixed.

Passive movement without an anaesthetic is useful in minor injuries such as sprains, to stretch synovial membranes, to break down recent fibrinous adhesions

within a joint, and to free tendons in their sheaths. It may also be employed to release muscles which have formed unnatural attachments to the ends of bones in cases of fracture.

Its application is chiefly beneficial to joints which are temporarily disabled, though otherwise healthy. It should always follow massage and not precede it.

By Active Movement is meant that which is performed by the patient himself acting through his voluntary muscles, and often against resistance, for instance, when he tries to flex his elbow while his hand grasps an appropriate weight running over a pulley. Even better than simple massage for restoring vigour, renewing the use of injured parts, and preventing the wasting which is almost sure to follow, is the combined employment of massage and of the patient's voluntary movements, against resistance, particularly in conjunction with the aid of mechanical contrivances. The value of voluntary movements and their superiority over massage or passive movements are well exemplified by the satisfactory results attained by the modern method of treating scoliosis and some other muscular affections. Mr. Howard Marsh (Clinical Essays and Lectures, 1902) states that the chief conditions for which massage and exercises are suitable are the following:-

(1) Sprains and contusions of previously healthy joints, unattended by any material complication, i.e.

when there is no dislocation or even subluxation, no fracture, no displacement of tendons, and no pre-existing affection, such especially as tubercle or gout or haemophilia.

To this statement, as will be fully gone into later, the writer would make some qualifications. A careful diagnosis must in all cases be made to exclude diseased conditions of the joints.

III.

CONTUSIONS.

By the term contusion is understood a severe bruising of the tissues unaccompanied by any break in the surface, in other words a subcutaneous injury.

Contusions are met with frequently and very considerably in severity. They are the result of direct violence applied from outside, such as falls, blows, crushes and the like. The parts that are bruised are really torn and the blood vessels bleed into them. If the bruised area is opened up and examined, more or less tearing of the tissues will be noticed, and the whole space is infiltrated with blood, partly clotted but chiefly fluid. The bleeding very soon, almost immediately, gives rise to a swelling accompanied by pain which, in its turn, is the result of the pressure of the infiltrating material on the cutaneous end-organs.

Seeing that bleeding into the tissue is the most important and earliest result, our first aim in treating such an injury should be directed to limiting its amount. Various means have been from early times adopted for this purpose, and amongst the most resorted to at the present time are the applications of cold, warmth, and pressure. Whilst one practitioner will lean to cold applications, using ice-bags, Leiter's coils with cold water, or evaporating lotions, another will highly extol warmth. The writer of this thesis, however, invariably uses elastic pressure applied, as

soon after the injury as possible, with the aid of a pad of cotton wool and a roller bandage. This method has the advantage of being readily employed and is very convenient, and while it effectually and rapidly checks the exudation it materially assists the second important requirement viz. the absorption of the exudation. The elastic pressure continuously applied disperses the fluid parts of the blood from the injured site into the adjacent parts, whereby it is the more readily absorbed by the healthy lymphatics and veins and carried away into the general circulation.

It is of advantage to keep the pressure up continuously for at least four hours. By then the lacerated openings in the vessels will have had time to be sealed off by clotting of the contained blood and the vessels themselves to have contracted. If the pressure be now removed, a sudden flushing of the skin takes place and, while this must tend to deplete the deeper parts, more fresh blood is brought to restore healthy nutrition locally and further wash onwards the vitiated and dying material. After the flushing is completed the pressure should again be applied. In the course of 24 hours most contusions will be considerably reduced in size, if they have been treated promptly. In some situations, as in the face, (black eyes) they may have quite disappeared. The pressure must be uniform, or the absorption will be irregular; (e.g.) in the treatment of an ordinary "blackeye" if in

packing the orbital space, the wool should be irregularly distributed, that part most completely under the pressure will be pale and flattened, while that on which the pressure has been faulty may be swollen and discoloured.

In the more extensive injuries the further absorption may be assisted by the aid of massage. As we have seen in a former chapter, massage is a very important therapeutic agent in the absorption of chronic inflammatory materials and serious exudations. If employed in acute inflammations, it is likely to prove harmful and to make matters worse; so likewise is its use to be indicated in contusions before the haemorrhage into the tissues has for certain ceased to flow. It is after this stage that massage is so valuable. In the smaller contusions "effleurage" may be quite sufficient, which in the larger even "petrissage" may be absolutely necessary.

SPECIAL CONTUSIONS.

Bruises sometimes of considerable size occur on the scalp, from blows and accidental kicks received at football. The effusion is for the most part under the scalp, and the swelling gives rise to a good deal of neuralgic pain. Some wool and a tight bandage applied for some hours are all thst is required in most cases. Massage later in the case is useful in relieving the pain, - which may persist even after most of the swelling has disappeared.

CONTUSIONS OF THE FACE, including "blackeye", are exceedingly common and are due to direct violence. They may be unilateral, when the violence is applied directly to the orbital organ, or bilateral, when the bridge of the nose suffers. Such local remedies as cold rags, raw beefsteak etc, are of little or no value in checking the swelling, unless applied at once. Elastic pressure on the other hand, if employed immediately, is far and away the most convenient, cleanly, and efficacious. In 24 hours the swelling will for the most part have disappeared, though some of the discolouration may remain.

CONTUSIONS OF THE LIP sometimes reach considerable proportions but are as a rule small, because the lip is more commonly cut by a tooth which allows most of the extravasation to drain away by the wound. The treatment is the same as in the foregoing.

HAEMATOMA AURIS, or "Football ear", for some reason unexplained seems to be less common than formerly, for while the writer collected no fewer than 13 cases in the Winter of 1890, in 1896 he saw only 5, and in the season 1902-1903, 2 cases. The slight difference in the formation of a "Rugby Scrum", as it is today arranged, whereby the ball is immediately passed out, may give less opportunity for the grinding together of the players' heads. The wearing of ear-caps as a protection has come also into vogue. The effusion takes place between the skin and cartilage of the ear,

and is more generally to be found situated in the concha. If neglected or allowed to recur again and again, it may lead to considerable thickening and puckering of the ear, and permanent disfigurement.

Very small haematoma, if painted with liguor epispasticus and protected from further violence, will be well in about 10 days' time. Football should be prohibited for at least ten days, otherwise even a slight blow will cause a return. In recurrent attacks a free incision should be made into the swelling and the clots turned out. It is a very simple procedure, and with strict asepsis the wound will heal very rapidly, and there will result much less deformity than when the treatment is by counter-irritation. The swelling is not infrequently situated in the fossa of the antihelix and occasionally in that of the helix.

Contusions may be met with in almost any part of the trunk, and require to be dealt with on ordinary principles.

THE ABDOMINAL VISCERA are sometimes injured by squeezes or blows.

One or other Kidney may be so contused as to giwe rise to much tenderness and pain in the loin, followed sometimes by "feelings of sickness or faintness", and accompanied by sharp attacks of haematura. The writer has met with 9 such cases in fourteen years. In six of these the cause was a "charge" from behind or from one side by an opponent playing under the

Association rules. In two of the remaining three cases the accident occurred through the patient being tackled strongly around the waist, and in the other by a fall against a goal post. The treatment is rest in bed with a low non-stimulating diet and bland drinks. The haematura though severe at first, sometimes disappears entirely in about 24 hours, while in other cases it recurs at varying intervals for the best part of a week. Pain is not a prominent symptom, and for this reason it is often difficult to make the patient realise the importance of restricted movements. The amount of the haematura does not seem to influence the ultimate prognosis, for while in some cases when the bleeding is copious this symptom disappears rapidly, in others the haemorrhage though small in quantity keeps recurring for some days.

The testis is very often bruised in riding, and injured from blows and kicks at football and other games. The haematocele is generally slow in being absorbed. The testis should at once be suspended, and the patient placed in a recumbent position in bed or on the sofa. When the acute stage is over, the organ should be strapped and supported until all swelling has disappeared. If the haematocele is very large and painful, an incision may with advantage be made, the clots turned out, and the tunica vaginalis drained for 24 hours, then closed, and bandaged with the application of elastic pressure.

In the upper extremity the bruises round about the shoulder-joint require serious attention. Perhaps in no region of the body is muscle-wasting more rapid in its appearance or the ultimate recovery more tardy. Contusions in this situation are very common, and are occasioned by almost every variety of direct violence. Every movement of the arm gives rise to more or less severe pain, and the patient for this reason keeps his joints rigidly fixed. The large bursa under the deltoid muscle is generally filled with blood, and the pressure on this muscle by the effusion both superficial to it and beneath it probably has some influence on its nutrition. Whatever may be the exact reason, the fact remains that rapid muscle-wasting and stiffness of the shoulder-joint will result. Rest for 24 hours should be absolute, and followed by gentle massage and early passive movements. Flexion and extension should be practised first, abduction and adduction later. The stroking movements of massage should be employed always before any attempt at passive movement is made; otherwise, there will be spasmodic contraction of the ruptured muscle, giving rise to considerable pain. Active movements should be commenced as soon as the pain will permit, for nothing prevents deltoid wasting with more certainty. The writer once observed considerable haematura which filled up the axillary space. A gentleman in suddenly catching at a rope when he was falling from the

rigging of a yacht felt a "sharp pain as if something was torn". Some important blood-vessel must have been torn across. The case did well after it had been drained by an incision. No definite bleeding point was found at the time of the operation.

In the lower extremity contusions are very frequently met with, especially as the result of football injuries, kicks, and so forth. Among the most important is that which is known in school-boy football parlance as "the poop taken". The front part of the thigh receives a kick, the pain is severe, and the player for a time is unable to move. The quadriceps extensor becomes powerless, and even walking is for a time impossible. Swelling rapidly supervenes and the space between the rectus femoris and the crureus muscle is filled with blood, extension of the knee is checked by the pain when an effort is made to move the extensors, while flexion is limited by the swelling under the extensors which may be considerable.

The following description was penned for the present writer by an undergraduate, who suffered from this disability. "I was playing 'Rugby' on February 7th. the ground was hard owing to frost and almost unplayable. I was heavily tackled early in the game with my thigh across the leg of the man who tackled me. I stopped for a few minutes as my leg became painful and very stiff. At a later stage in the game in tackling I received a man's knee in the middle of my

thigh as he came down on top of me. The result was painful and I was almost unable to move my leg for the rest of the game. By the evening the thigh had swollen to a considerable size and was very stiff and painful. The pain was gone before next day but the swelling and stiffness remained for many days." Writing on March 12th. of the same year he stated that the swelling had subsided almost entirely. This case had not been treated until four days after the accident.

With absolute rest and pressure and daily massage the cure is generally rapid; if, however, a second blow is received in or near the same place within a short time of the recovery, the secondary contusion will be a much more serious matter. Recently three such cases have been brought under the writer's notice. The first was that of an undergraduate aged 19 who received a kick at football, and after having exhibited all the symptoms above narrated played a match contrary to advice a fortnight later. He was unlucky enough to run into another man's knee within five minutes of the start of the game, and had to be carried off the field. The thigh at once swelled up again, and the resulting haematonia was larger than its predecessor. The ultimate recovery was complete but very slow.

It is advisable in these cases that massage should not be attempted for at least three days, as it has

been found to increase the extravasation between the deep layers of the muscles, if commenced as early as it is in more superficially placed contusions. Later on, it is most helpful in conjunction with active movements. The active movements are more useful than passive as they prevent muscle-wasting with more certainty.

IN THE LEG bruises are very frequently met with in football players, especially in those who are engaged in scrummaging. They are usually the result of a "hack" or kick. In the majority of cases they are subcutaneous and trifling, and limited to the front or side of the shin. In the more severe cases they are subperiosteal and give rise to tiresome aching which is worse at night. The subperiosteal effusions are generally limited in area as the periosteum is not easily stripped from the bone. When dealing with the chapter on Fractures later on, reference will again be made to these cases and their consequences. Very extensive haemorrhages are sometimes to be found in the substance of the tibialis anticus muscle, and are limited therein by its sheath. Fluctuations may often be elicited. The pain is however but slight, and hence the subjects of this injury are with difficulty prevailed upon to cease from walking or taking part in games.

The treatment in all degrees should first and foremost be rest with elastic pressure at once, and

massage not sooner than 48 hours afterwards. This line of treatment must be kept up, even after all swelling has disappeared. Blistering is sometimes necessary when the absorption is slow. Relapses are frequent, and should be carefully guarded against, by the use of "shin guards" whenever football is played. This game should not be allowed for at least a week after all symptoms have disappeared. Of all contusions these are perhaps the most common.

There is one contusion which is met with in the matrix of the great-toe nail, in sprinters and long-distance runners who wear running shoes with spikes. It may also be seen in the persons of ordinary athletes who wear boots that are too short. In "running pumps" the toes are forced into the pointed and cramped extremity, with the weight of the body at each stride forcing the toe-nail against the shoe. The result is a haemorrhage into the growing matrix of the nail, giving rise to a "black-nail", pain, and eventually death and shedding of the organ. The remedy is rest, a square-toed shoe, and depletion of the haemorrhage. Many athletes shed the great-toe nails every season, simply because they will not wear properly shaped shoes. By scraping the root of the nail until it is quite thin, an opening may be made to let out the blood. The nail in this way is often saved. The operation is not painful.

IV.

SPRAINS.

If the movements of a joint be carried beyond their physiological limits but short of actual dislocation or separation of the bones entering into its composition, the injury resulting may be described as a SPRAIN.

Many accidents produce sprains. Any outside violence, such as a fall whereby the movements of flexion and extension are overdone, and the bones unduly forced into some unnatural position, is perhaps the most usual cause.

Twists, as when the ~~part~~ foot is fixed and the body is made to rotate forcibly at the knee joint, add their contribution. Many strains arise from violent muscular action, especially amongst those who "go in for" athletic exercises, and although perhaps not quite so frequent as the two other classes, are for our special purpose here the most important. Congenital deformities, such as club foot and knock-knee, are in some instances predisposing causes, whereas a previous injury either to a joint, or to the muscles which support it is in the case of athletes, at any rate, the most common. Another predisposing cause is "being out of training", when the particular game or pastime is first resumed. The muscles which surround and influence the joint are not sufficiently braced to support the ligaments binding the bones together. After the injury has existed for some days the greatest difficulty is often experienced in ascertaining fully what the exact lesion is. It varies considerably in different cases. As the

ligaments are the most important structures which bind bones to bones, we are forced to regard them as of primary importance in the pathology of this injury - since they must of necessity bear the chief strain in the excessive movements of the joint.

In the simplest cases they are merely over-stretched or but slightly torn; in more severe ones they may be partially or completely torn across, when even the capsule of the joint is damaged. They may also be torn from their bony attachments so that a fragment of bone is separated with them.

The amount of damage will depend upon the degree of violence as well as upon the form, shape, or strength of the ligaments. A rounded, short, and thick ligament, is less likely to succumb to the undue strain than is a thin, long, and flattened one. In many cases a separation of an epiphysis or even a fracture of a bone will occur before the strong ligaments will give.

The dislocation of an interarticular cartilage, as is found at the articulation of the clavicle with the sternum, or as occurs in the case of the semilunar cartilages in the knee, may result from the partial or complete separation of the ligaments. In the most severe injuries the muscles and tendons surrounding a joint rarely escape. They may be torn or dislocated from their normal connections and attachments. Some blood vessels to a greater or less extent are always

torn asunder, and occasion bleeding into the joint or surrounding tissues. The nerves, being tougher and often tortuous and but slightly on the stretch, are rarely affected except secondarily by the pressure of the effusion.

Pain, immediate loss of power, and rapid swelling of the joint supervene early in the case. If left to itself or improperly treated such a joint will remain weak and insecure, or even stiff and painful. In the mildest cases at first pain and temporary loss of power are the cardinal symptoms. The swelling does not take place immediately, but comes on later owing to an increase of the synovial secretion in the joint.

In other cases the swelling is immediate, caused by bleeding into the joint-cavity and its surroundings, owing to the laceration of the blood vessels,

This tumefaction increases later by the addition of synovitis.

The future of the joint will depend partly upon the amount of effusion, and partly upon the extent of the damage to the ligaments and other structures.

If the synovitis is allowed to remain without treatment it may exist for weeks: during all this time the capsule, being distended by the effusion is weakened, and put upon the stretch, and the joint suffers.

Adhesions when formed between the various parts of the synovial membrane, though very delicate and

and unimportant at first, become organised and form firm bands. The cavity of the joint in this way becomes partially or wholly obliterated.

The blood which escapes into the cavity is ~~instant-~~ but slowly ~~ly~~ absorbed, and in the ordinary course of things remains fluid for some time.

Portions of the capsule and synovial membranes, after being torn across, form new attachments, or may even curl inwards into the joint and impede the play of the bones one upon another. These various disabilities may arise, producing as their remote effects, a weakened, painful, stiffened, and almost useless joint.

It behoves us, therefore, in the first place to check or limit the exudation into the joint, and then to encourage its removal by every means at our disposal, and as quickly as is practicable. The satisfactory healing of the torn tissues must be promoted and the normal movements restored.

Having cursorily entered into the causes, pathology, and results of sprains, as well as having enumerated the principles upon which the rational treatment is based, it may be well here to consider the method or methods employed in the writer's own practice.

First and foremost it is his invariable rule to put the joint through all its usual movements. The object of this is to extend fully the synovial membrane within the joint as well as its capsule.

In this way any fibres of the capsule which may have curled inwards and become caught between the articular surfaces will be freed and restored to their normal position.

When this has been done, instead of placing the limb upon a splint and applying cold or hot applications as is recommended in most text-books, it is a good rule to place the limb in the most comfortable position, generally that of slight flexion, or that assumed naturally by the muscles influencing the articulation. The effusion into the joint and the posture assumed are nature's ways of ensuring rest, and should be imitated.

The usual practice of applying cold, either by Leiter's coils or evaporating lotions with the idea of limiting or checking haemorrhage, is in the writer's way of thinking quite useless. The haemorrhage in some injuries occurs at once, in 9 out of 10 cases before the surgeon sees his patient, and therefore cannot be influenced by cold, even if intense. The practice seems to be based upon theoretical grounds. The bleeding ceases by reason of the increased tension in and around the joint, and the amount of blood in the joint is limited by the capsule itself. As soon as the pressure in the tissues or joint becomes equal to the blood-pressure in the vessels, the bleeding will cease, and this fact, as illustrating nature's effort to check the haemorrhage, induces the surgeon to

to employ elastic pressure for the same purpose.

Warm applications even from theoritical considerations cannot possibly check the effusion, for it would be impracticable to use heat sufficient for the purpose without at the same time damaging the skin over the joint. Warmth indeed would tend rather to increase the effusion.

Elastic pressure, if applied by means of layers of smooth cotton wool carefully and evenly placed on the joint with a thickness of at least 1 inch and then bandaged on firmly with either a domette or crêpe bandage as tightly as the surgeon can draw it, will limit the effusion and cause its absorption. It has been said that this is a painful method and that patients are unwilling to submit to it. With an experience of over 14 years and of many cases the writer has seldom, if ever, met with any such complaint. Any such alleged inconvenience must have arisen either from the limb having been placed in the extended position and upon a splint, as is so often done and recommended to be done, or because the amount of wool has been insufficient. The discomfort in the former arises from an increased intra-articular pressure, and in the latter from partial strangulation of the limb.

If the case is seen early and elastic pressure is immediately applied, the effusion will be slight. The bandage should be removed in 12 hours, and the limb

gently stroked upwards from the extremity, pressing very lightly over the joint. This has a wonderfully soothing effect on the part, and diminishes pain. The wool and bandage should be re-applied for 24 hours and then removed; after this the limb should be for a few moments longer rubbed, and passive movements be commenced. The gentle massage should invariably precede the passive movements, for otherwise the muscles may be excited to resist. These manoeuvres should be performed daily for the first 4 days by the surgeon himself or a skilled assistant. By then the effusion within the joint in mild cases will have disappeared and the massage will have dispersed that around the joint, between the muscles and in the tendon-sheaths. All this time the patient should be kept in bed or on a sofa without wearing any definite splint. A sand-bag may be helpful, or the limb may with advantage be placed on a pillow and somewhat elevated.

Active movements should not be allowed until the fluid has entirely disappeared from within the joint, and at first should be limited to flexion and extension. Rotatory movements should not be permitted, nor should the limb be allowed to sustain any weight. If the joint is daily massaged and moved, in slight cases the patient should be able to walk in from eight to ten days and to join in games a week later.

In more severe Sprains elastic pressure is applied,

and gentle massage carried out daily after the first 12 hours. Passive movements may with safety and advantage be commenced after 36 hours. The writer has never seen the slightest harm accrue from the use of passive movements, nor is there any pain if one takes the simple precaution of practising them always after the massage. The muscles in this way are not put on the qui vive, and the resistance or even spasm which occurs reflexly when an injured joint is suddenly or roughly manipulated, is overcome.

Passive movements however do not seem to prevent muscle-wasting, although most useful in preventing the formation of adhesions within the joint, and no doubt promoting absorption to some extent.

It is necessary for the prevention of muscle-wasting in some injuries (and this is often a serious complication, and perhaps one of the worst results of improperly treated sprains), that massage should be kept up, and that Active movement should be commenced as soon as it is safe. There are some surgeons who argue the advisability of beginning Active movements at once. ~~From~~ write this the present writer totally and emphatically disagrees. It has been his misfortune, in not a few instances, to meet with joints rendered weak and insecure from the distension of the capsules with synovial fluid and blood which have been allowed to remain in them for indefinite periods, purely owing to the advice that "the more

the joint was exercised the better".

More will be said of active movements and the methods of carrying them out when the subject of joints rendered stiff from old sprains etc. is considered.

Even in severe sprains, if properly treated by the method above advocated, the patient ought to be quite well and able to play at any game in 21 days.

Statistics of Sprains in 14 years.

1889 to 1903.

	Left.	Right.
Knee	163	97
Ankle	71	63
Shoulder	56	61
Elbow	52	73
Wrist	41	52
Thumb and fingers	38	49

These statistics are not sufficiently comprehensive to allow of any important deductions being made. It may be noted however that in the case of the knee the injuries occur nearly twice as frequently on the left as on the right side. In the case of the shoulder, elbow, wrist, and fingers, there is a preponderance of the right-sided injuries. This may probably be explained by the more general use of the right hand in most games, while, in the case of the lower limbs, for the same reason the twists or rotating movements at the knee and ankle are most

frequently from right to left, (Vide later in causation of internal derangements of the knee-joint).

Even after the patient has been able to use active movement for some days, but not yet capable of putting much strain on the joint, massage should still be employed daily. When walking is commenced, it should be only for short distances, and a bandage should be worn.

A patient may with profit wear an elastic bandage while playing, but it should be removed directly afterwards. The custom frequent among athletes and others of wearing elastic bandages on their knees and ankles is a bad one. The pressure, acting always, limits the proper circulation of the blood through the muscles and connective tissues around the joint and thereby impairs their nutrition.

If the blood is ~~extensive~~ excessive and is not absorbed as quickly as it ought to be, antiseptic aspiration or arthrotomy with drainage may be utilized (Vide operative methods in later chapter).

When an important ligament has been torn the movements must be very carefully regulated by the medical man himself, or the person who performs the masage should be made acquainted with the anatomical details. It takes about a month for a strong ligament to be united sufficiently firmly to prevent its yielding or stretching on being strained. The union is complete in about eight to ten days but the cicatrix is

soft and yielding for some ~~months~~ weeks later. For this reason it is advisable to wear a bandage for some time after the joint is first used.

When portions of bone have been detached with the ligament, the treatment is the same as for a fracture. It is only when this complication arises that splints in the writer's opinion are advisable. The splints should be removed daily to allow of massage and movements.

DISCOLATIONS.

The treatment of dislocations has been much changed during the last decade. Whilst formerly a joint was kept fixed and immovable by bandages and other artificial contrivances for from 2 to 4 weeks, now-a-days, few practitioners will approve of so long a period of enforced quiescence. Gentle massage and passive movements may with perfect safety be begun as soon as reduction has taken place, and active movements a few days later. These voluntary movements should be restricted at first to the muscles that are not concerned in the production of the dislocation. Thus, if a shoulder be the object of treatment, the movements of flexion and extension may very soon be induced, while abduction should be postponed until the capsule is partially repaired. In default of this precaution, the powerful and sudden or even spasmodic action of the deltoid may reproduce the dislocation. In the space of 8 days sufficient union will have taken place, but even then abduction must be performed with caution. During the time that active movements are of necessity in abeyance the particular muscle or group of muscles may be kept from wasting by gentle massage and daily passive movements.

By this more rational system of massage and movements, even a hip-joint may be enabled to bear the weight of the body in three weeks, while an elbow will in this time become as supple and useful as it was

before the accident.

Dislocations are the result of the same kinds of violence as cause sprains. When the force producing a sprain in a joint is carried to an excessive degree, especially if the surrounding muscles are taken off their guard, the ligaments may be torn and damaged as to allow of a separation of the bones, spasmodic contractions of the muscles follow, and retain the bones in their unnatural position.

Dislocations may be partial or complete. Of the partial forms perhaps the best known examples are the subluxations of the semilunar cartilages in the knee-joint. So important are these affections that it is proposed later on to devote a chapter to their full consideration.

The partial luxations to which athletes are liable may be briefly mentioned at this place.

A partial luxation of the lower jaw is sometimes to be found in boxers. It results from a violent, unexpected blow on the tip of the chin when the mouth has not been firmly shut. The treatment is limited to rest, and massage over the joint.

The subluxations of the semilunar cartilages of the knee have already been alluded to.

The patella, though rarely, presents instances of partial luxation. The writer at the present time has under his care a school-boy who has on three separate occasions in the space of two years suffered from this

disability. It has invariably occurred while he was playing at hockey. Strange to say he is able to play in his School fifteen at football without suffering any serious inconvenience. So far it has been impossible to ascertain with accuracy what is the exact muscular movement in hockey which leads to this abnormal shifting of the patella from its natural position to the outer side of the joint. The reduction was readily effected by the boy himself on the first two occasions. On the third there seems to have been considerable difficulty in replacing the bone.

The treatment has been rest in bed, and gentle massage to relieve the tendency to spasm in the quadriceps extensor, followed by elastic pressure to remove the effusion into the joint. Now that the effusion has been absorbed (eight days since the injury), ~~he has begun~~ have been commenced passive movements. A few days hence he will be encouraged to exercise the muscles of the thigh and leg by means of graduated weights over pulleys. In this way not only will muscle-wasting be prevented, but the patella-tendon, and fibrous expansion from the extensor muscles, as well as the muscles themselves, will be strengthened by the effort of resistance supplied by the apparatus.

The principles of treatment are aimed at preventing a recurrence of the injury, and nothing is so effective for this purpose as a gradual development of the strength of the muscles. It has been found from experience

that a strip of plaster 3 inches wide applied in a circular manner around the lower third of the thigh (vide illustration) limits and directs the pull of the contracting extensor muscles.

After falls upon the Shoulder not infrequently severe pain is felt, accompanied by swelling over the site of the acromio-clavicular articulation. The writer firmly believes that in these cases the precise condition is one of subluxation rather than a sprain. On two occasions he has observed a slight crepitation when the palm of the hand was placed over the swelling, passive movements being at the same time carried out. An X-ray photograph in each case showed that no fracture existed. The same condition of things probably occurs in violent strains put upon the sterno-clavicular joint.

Dislocations are very likely to recur if the particular game is resumed before the capsule and ligaments have become firm, and it is better for the surgeon to err on the side of caution when requested to state a given time for the resumption. It is a good plan to recommend massage for some weeks.

Ordinary complete dislocations are so well dealt with in text books on surgery that only slight reference other than to their treatment is necessary. They can be treated very successfully by the methods that the writer advocated when dealing previously with severe sprains.

VI.

FRACTURES.

Almost every variety of fracture may be met with amongst athletes. Such games and pastimes as polo, steeple-chasing, and fox-hunting are responsible for the most serious cases, yet they may be caused by any form of athletic exercise.

Whilst direct violence, such as falls and blows supplies the greatest number, twists and sudden wrenches produce a few cases. Enforced muscular action contributes also, for separation of epiphyses and fractures of the patella are brought about entirely by this kind of strain.

To enter into anything like a complete description of the various fractures, their causes, pathology, and treatment, would be out of place in a treatise such as this is intended to be. For the present purpose it will be sufficient to discuss briefly the more modern methods of treatment, and to enquire as to how far they are useful, and better adapted to modern requirements:-

"A fracture is nothing more than an exaggerated form of sprain, the bone, in addition to the soft parts, having been torn". (Sir Wm. Bennett, "Massage in recent fractures", 1902).

In modern times no surgeon of experience would hesitate to recommend massage and movements in a recent sparin, even if it was severe. The only possible contra indication is the presence of a wound or blister.

For generations a sort of fetish has existed amongst practitioners as to the belief that non-union of fractures invariably results unless the fragments are immovably fixed together. This false belief or bogey, has vanished or is vanishing - for daily experience has taught every careful observer that such injuries as fractures of the ribs and clavicle mend admirably, although immobility is impossible. Many other instances may be cited. The perfect union that is sometimes seen in the fractures occurring in wild animals (rabbits and pheasants) that have been caught in traps, is an excellent example.

Again in bones that are kept absolutely fixed, or in which from their anatomical situations no movements are allowed, non-union occurs.

It must not be assumed, however, that from these examples we are to make the deduction that movement is necessary for union, but rather that in some instances at least, instead of its being detrimental, it may be even useful.

Massage and movements for these reasons may be recommended. "Effleurage" should precede movements, even of the passive kind, for by its use anything like spasmodic or jerky movements of the muscles, which add to the pain, can be avoided. It has in itself a powerful influence in lulling pain, probably by improving the nutrition of the nerves ~~through~~ by encouraging the circulation and flushing the part with fresh blood.

A fractured limb that has been treated by splints and kept fixed for many weeks is oftentimes painful, and stiff. When the patient wishes to resume his usual movements he is loth to do so because of his suffering and inability. The crippled state arises more frequently from adhesions than from faulty union.

It is an excellent plan to begin passive movements as soon as the fracture has been "set". If the injury is in the leg, the tendons of the toes may be moved from the very first, and while the splints are still applied. In this way any adhesions which may form between the tendons and their sheaths are stretched or broken down, and the muscles are prevented from contracting any attachments to the bony fragments.

This backward and forward movement has been called "internal massage", and is productive of the greatest good. Later on the splints must be removed temporarily each day, to allow of surface or external massage, - which assists the passive motion materially.

Voluntary movements, at first very gentle and limited, should follow as soon as the union is sufficiently good to allow of their exercise. They may be gradually increased each day. Muscle-wasting ceases as soon as active movements are begun.

In performing early passive movements great care must be taken to fix the site of fracture either with a splint or by the hand of the operator. The distal fragment must be brought to the proximal, and not

vice versâ. Attention must also be given to posture, and as a rule, it should be that whereby complete relaxation of the muscles is attained, or which affords the greatest amount of comfort to the individual. The modern treatment of fractures by the combined use of massage, movements, and posture has revolutionised surgical procedure and produced an appreciable saving in the time during which the individual is placed "hors de combat".

According to Sir William Bennett's computation, (Lancet 1897) at least one third of the time is saved. To the athlete this is of signal importance, for nothing is more irritating or disappointing to an energetic and capable man than to be debarred from exercise for a long time.

The plan however cannot be regarded as likely to supersede all others, such as the use of splints and operations, but in all cases will greatly assist them.

Separation of Epiphyses and other fractures.

Schoolboys and undergraduates who take part in athletics not infrequently have their epiphyses detached by violent muscular efforts. Many cases are on record. Without attempting to enumerate the more familiar, the writer would draw attention to a few unusual cases which have occurred in his own practice.

He published in the "Lancet" for November 1893 a full account of two cases of separation of the anterior inferior spinous process of the ilium through enforced

muscular action. In each case an undergraduate under 19 (for at this age the epiphysis usually unites), suffered from this accident. They were both "sprinters" of reputation. The one detached the epiphysis in "starting" to run the "100 yards", and the other while competing in the "Quarter mile". Both patients stated that after running a few paces they felt "something snap", and "were unable to proceed". The pain was not severe but they were "sick and faint". Other symptoms were tingling and a feeling of "cold water trickling" down the extensor surface of the thigh. The limb was in the position of semiflexion and in advance of its fellow. There was a slight discolouration, and an inconsiderable swelling could be made out beneath and to the outside of the middle of Poupart's ligament, the situation of the inferior spinous process of the ilium. Any attempt at straightening the thigh upon the pelvis or the leg upon the thigh so as to put the rectus femoris upon the stretch gave rise to pain. On deep palpatation, when the limb was moved, some crepitation could be elicited. The cases were seen within two days of each other, and presented a very marked similarity in their symptoms. In the second case, the crepitation could hardly be made out, but the tingling was the same. This unusual sensation existed in both instances for some days, and was more complained of than the pain. Thus, the history and aetiology of these injuries were remarkably

alike. "Each patient had started with his left limb somewhat flexed both at the hip and knee joints and in advance of the right, the body being bent forward, and, as it were, poised upon and supported by it. In the sudden act of starting, the limb behind was used to give the spring, and in the first bound the body and the advanced and flexed limb being suddenly and quickly straightened together, the rectus muscle, already contracting and fixed at its lower attachment to support the weight of the body on the semi-flexed knee, being forcibly put upon the stretch during the sudden extension of the hip joint, tore away the unossified epiphysis of the anterior inferior spinous process of the ilium".

The anatomy and pathology were so fully described in the paper in the "Lancet"that they do not need repetition here. The photographs show the structure of the epiphyses in a subject aged sixteen years;they are not fully united until the 19th. year.

The treatment was simple. A plaster spica-bandage was applied, the limb being fixed in a position adopted to relax the straight head of the rectus muscle. The splint was retained for four weeks when an ordinary bandage was substituted. Both cases did well. A considerable amount of callus was thrown out in one case, but notwithstanding this the patient was afterwards able to "run successfully". The other patient gave up running as "he lost his pace". If this was

described as the "sprinter's" fracture the phrase would have as much propriety as the expressions "rider's sprain" etc.

Separations of the epiphyses, such as those at the ends of the various long bones, are occasionally seen in school-boys and young people. The most frequent are those near the elbow-joint, arising from wrenches and twists which occur at gymastic exercises. Blows from a cricket ball have been known to produce separation of the phalangeal epiphyses.

The patella may be fractured by muscular force. The writer has seen it result from a slip at football. The fracture may take place at the apex or through the middle or any other part of the bone. From the athlete's point of view it is a very grievous accident and one likely to put a check to his career. If the pathology is considered, it will be obvious that the operative methods of treatment furnish the best chance of firm and early restoration of movement. Various methods of operative procedure have been utilized by different surgeons, but the modern tendency is undoubtedly in favour of wiring the fragments by the "open plan". Though affording the best and quickest results, it is by no means free from danger, nor should it be undertaken lightly. The older ways of employing splints and fixed apparatus for prolonged periods are still to be resorted to whenever an operation is deemed unadvisable. Occasionally the results without

operation are good, but in many cases they are obtained only after long periods of quiescence. When splints are used the patient must be for many weeks upon his back, the limb must be extended and placed upon a back splint, and suitable means adopted to bring the fragments together.

When the patella is snapped across there is always some tearing of the capsule of the joint as well as of the synovial membrane. The articulation is immeditately filled with blood which clots and tends to keep the fragments apart. The bone is torn asunder more quickly than the periosteum which encloses it, so that the torn fibres of the periosteum curl in between the fragments and, acting after the manner of a foreign body, prevent complete union when they are brought together. The extensor (quadriceps) muscle by contracting separates the fragments still more.

If the joint be now opened, under the strictest possible antiseptic or aseptic precautions, the blood may be sponged or washed out. The fibrous periosteum which falls between the fragments should be scraped or clipped away. In many recent cases, if there has not been excessive laceration of the lateral expansions of the quadriceps tendon, the fragments of bones are not far removed from one another, and may be readily brought together. It is the custom to fix the several portions of the patella by means of silver wire. In many cases an excellent result is

obtained and there is no trouble; but in others the wire has been known to cut its way out when movement is first tried. During the last two years the writer has abandoned the use of wire. He has employed in five of his most recent cases a suture composed of an absorbable material. In four cases ordinary cat gut prepared in Xylol and kept in spirit, was used, and in the fifth, kangaroo tendon. The advantages of the absorbable material are that it disappears after it has served its purpose in about three weeks' time, and never sets up any irritation, nor does it require removal.

The operation advocated by the writer is to open the articulation according to the strictest aseptic principles, by means of a longitudinal incision of several inches in length over the middle of the joint. The clots and blood are swabbed, not washed, out of the cavity, and any fibres of the periosteum which may be found curling inwards and lying on the face of the bony fragments, are carefully and systematically cut away with scissors. With a sharp spoon the bony edges are refreshed. The joint is again swabbed out and every possible bleeding point is ligatured with fine catgut. If any oozing continues, he washes out all the interstices of the synovial sac and its various pouches with normal saline solution, which is at the temperature of 100° F, and has been sterilized by previous boiling for a few minutes. This will

generally cause all oozing to cease. The fragments are now seen to fall together more or less readily, for they have previously been kept apart chiefly by the distension of the capsule by the blood clot. As a rule contraction of the quadriceps tendon has very little to do with the separation in recent cases. By passing a stout curved needle threaded with catgut or kangaroo tendon through the patella-tendon from without inwards, and drawing the thread through the joint under both fragments, the needle is brought out through the quadriceps tendon from within the joint outwards and as close to the upper edge of the patella as is possible. In bringing the ends of the thread together it is possible to gauge at once the amount of tension that exists. Usually there is very little. One or two more threads are passed in the same way, and then all are tied across the front of the upper and lower fragments. In this way the repaired bone is encircled with two or three stout strands of catgut, and an even and complete apposition is established. The torn edges of the capsule are also sutured with catgut, and the joint is drained for 24 hours with a strip of sterilized gauze through a separate opening. This is made through the capsule at the outer side of the joint at a spot indicated in the accompanying photograph (on the next page). The objects of the drainage are (1) to prevent the joint from refilling and putting undue tension upon the sutures, (2) to relieve pain

and the discomfort always caused by a distended knee-joint when kept in the fully extended position, and (3) to allow the mucin, which very often is to be found coagulated and deposited like boiled grains of sago, in the joint to be expressed through the opening. If this material is not removed it remains for a long period unabsorbed, and tends ultimately to produce adhesions between the different synovial surfaces of the articulation, thereby impeding the perfect movements aimed at in the after-treatment.

The limb is then dressed with absorbable layers of gauze, sufficiently thick to allow of elastic pressure being applied over them by a tight domette bandage.

A back splint with a foot piece is then utilized, with the leg fully extended and inclined somewhat upwards. In this position all tension is removed from the sutured ends.

Twenty four hours later the gauze drain is removed, and the dressings are re-applied as before. On the 8th. day the skin sutures of silkworm gut are removed, and if the wound is healed gentle massage is commenced. This is practised daily and is followed by gentle passive movements, (the patella being moved from side to side) carried out by the operator himself or his assistant for a few minutes at each sitting. The splint may be removed in 15 days and the gentle active movements of flexion allowed, the patient lying in bed. In 21 days the union is firm and ~~flexion~~ the flexed limb may

be carried to a right angle. In 6 weeks almost any movement may be performed and the patient will be though somewhat stiff able to walk with comfort. Of the five cases mentioned all were perfectly well in six weeks. The photograph is one taken four weeks after the suture was made with catgut, and clearly shows the longitudinal scar, as well as the one on the outer side of the joint where the drain was inserted. This is the most dependent part of the joint cavity in a patient lying supine, and has therefore been found by the writer to be the most convenient spot for drainage. The subject of the photograph was a man aged 28 who fractured his patella in missing his kick at a football, and was treated at the Radcliffe Infirmary by the writer.

In cases in which for any reason an open operation is not advisable, the best apparatus is the back splint with foot piece, together with an elastic apparatus to draw the upper fragment downwards and keep it as near the lower one as possible. The important fact to note in such cases is that the patella is likely to become adherent to the femur and be of more trouble afterwards when movement should take place than even a fibrous union that is not perfectly strong. To overcome this danger, the patella should be moved from side to side early in the treatment, while the limb rests on the splint. As soon as the fluid is absorbed massage should be employed daily. The author has never known of any case of fractured patella in which

the patient has been enabled to resume athletics without having undergone an operation.

The fractures which occur in the olecranon may be treated on exactly the same principles as those for the patella. When no open operation is performed the upper fragment must be freed from any adhesions it may contract by early massage and passive movements. The writer has operated only once on the olecranon for an athletic injury, and in this case he used thick silkworm-gut as the suture. The wound healed by primary union, and the boy has now a useful arm capable of all its movements.

In operative as well as non-operative treatment it is most important that massage and movements should be commenced early, and, if possible, kept up all through the case.

INJURIES OF MUSCLES, TENDONS, AND FASCIAE.

In the pursuit of athletics muscles may be contused or bruised, herniated, or lacerated. Tendons are sometimes torn across, at others dislocated from their sheaths and natural positions, while the fasciae are split longitudinally or torn across transversely.

Muscles are contused from blows and kicks at foot-ball. Any muscle or group of muscles may be bruised from direct violence. If much bleeding takes place the muscle becomes painful and temporarily paralyzed. If the contusion is small, rest and massage beginning 48 hours afterwards will generally be sufficient.

In extensive contusions where the haemorrhage into the muscle is copious it may be wise to make a flap incision, to turn out the clots, and to drain. When the wound is healed massage should be utilized.

Herniae in muscles occur when from any supreme effort the muscle, in contracting, violently bursts its sheath. Small herniae are sometimes seen in the thighs of muscular athletes. The writer has observed two examples in the rectus femoris. In the one, an undergraduate, while wrestling, felt "something give", in his thigh, followed by a sensation of "burning" at the part. A soft mass could be felt and seen under the skin in the upper third of the thigh in the course of the rectus femoris. It was made more prominent when the muscle was contracted, and could only be moved after much manipulation. There was very little pain and apparently no loss of function. After

reduction, which was effected by digital compression and manipulation, a strong wide piece of plaster was applied firmly over a small pad of wool. For a time the muscle did well, but three months later a recurrence took place. As the patient would not allow any operation, the condition has remained permanently. No discomfort or weakness is complained of, although the mass is about the size of an average pullet's egg. The muscle is apparently united to the edges of the fascia.

The other case referred to was in an elderly man, aged 45, who while trying to shift a heavy ladder along the side of his house, overstrained the rectus femoris. He "felt something give" but suffered very little pain, and has been able to walk and go about his work ever since, suffering little or no inconvenience. The swelling is about the size of a hens' egg.

The obvious treatment in these cases would be to cut down upon the part, and, having reduced the hernia, to stitch up the opening in the fascia.

Ruptures of Muscles, whereby they are torn across partially or completely, occur as a result of violent action at athletic games. The partial are fairly common, the complete rare, and both result from some unusual and unexpected strain or into-ordinated movement - when the muscle is taken at a disadvantage. A rider has been known to divide completely both his adductor longus muscles in violently gripping his saddle while endeavouring to avoid being thrown by a

restive horse. The rectus femoris has been torn in the effort to avoid falling backwards of a patient who was skating. These accidents almost invariably occur in persons who are "out of training" and "unfit". As in the case of articular sprains, so in muscular strains, injuries occur more frequently at the beginningof the particular athletic season. The schoolboy or undergraduate,,growing rapidly, enjoying perfect health and becoming stronger every day, spends his long vacation in yachting, golfing or shooting, returns to school or college, and at once, without due preparation, begins to "play hard" at Rugby or Association football. The muscles are perhaps more vigorous than they were the season before, but the tendons have grown unaccustomed to the sudden pulls and jerks which are incidental to the game. The present writer, with his experience of many years at Oxford, has again and again noted the fact that quite three fourths of all the sprains and strains, articular as well as muscular, occur in the first weeks of the October term. During the long vacation the average man does not "go in" for athletics.

The laceration may take place in the middle of the muscle, as in the photograph on the next page which shows a long-standing rupture of the rectus femoris, but generally at its tendinous attachment or at a tendinous intersection. The long muscles are peculiarly liable, being more exposed to stretching violence. Amongst the most usually met with by the

surgeon are the adductor longus in riding, the hamstrings (biceps, semitendinous, and semi-membranosus) in broad-jumping, the rectus femoris in an effort to restore the balance in skating, the pectorales or deltoid in gymnastics, the plantaris in lawn-tennis, the tendo Achillis in dancing, the rectus abdominis and external oblique (digitations) in faulty rowing. Effusion of blood in varying quantity takes place between the divided ends and, if left to nature, results in a cicatrix which may even undergo ossification. As time goes on, the cicatrix which, at first, is stout and resisting, stretches considerably and, in these circumstances, the repair is seldom quite satisfactory. Great care is necessary for the proper cure of a torn muscle.

Generally the history obtained is that after sudden effort there was pain, loss of power, and a feeling of "something gone" in the affected muscle. A depression or gap may be seen or felt at the painful place with an elevation on the proximal side of the depression, due to a retraction of the upper part of the divided belly, the gap and swelling become more evident when an attempt is made at movement.

The ultimate prognosis is fair, even where important muscles have been torn across, and it is really surprising what little pain is sometimes felt at the time of the injury, and how little crippling follows even when the greater portion of an important muscle

has been severed.

The photograph depicts the depression, with the usual elevation about it, in the case of a rupture occurring in the middle of the rectus femoris of an undergraduate. He had made an effort to save himself from falling when skating. He felt the tear and had a little pain, but was able to continue skating for a short time. When seen by the surgeon, there was considerable swelling in the middle of the thigh from subcutaneous bleeding. The divided ends could not be kept together satisfactorily, even though a back splint was applied in an inclined plane with an elastic extension-apparatus. He would neither consent to an open operation, nor would he remain in bed as long as he was advised to. The pain was but trifling. In spite of the muscular gap which remains, he still suffers little or no inconvenience, and the limb is apparently quite strong. Two years after this accident he displaced the internal semilunar cartilage in the knee. This latter, which recurred on more than one occasion, so interfered with his pastimes that he urgently requested the writer to remove the offending cartilage. This was effected, and at the present time in spite of the complete removal of the internal semilunar cartilage he is able, not only to walk a long distance, but to ride and even to play at polo.

The writer has had <u>three</u> cases of rupture of the <u>adductor longus</u> muscle; the so called "rider's sprain".

In one patient it had been torn on each side of the body but at different times. The man, who is a horse-breaker, suffers no inconvenience except from the rounded swelling of the upper fragment on the right side when riding. The other adductors (brevis and pectineus) have increased in size to make up for the loss. He is able to ride quite as successfully as before.

The treatment is rest and strapping for a few days with massage, followed by active movements carried out by means of weights and a pulley. Complete repair will not take place without an open operation. The swelling might be removed if inconvenient.

The Hamstrings are sometimes partially torn near to their tendinous origins above. The writer has met with seven cases in fourteen years. Two were caused by broad jumping, three in sprinting, and the other two in falling from heights after climbing. In one of the cases a distinct gap, into which two fingers could be placed, was palpable about one inch below the tuberosity of the ischium; and in two others a smaller though distinct gap may even now be felt, although they occurred over six years ago. At the time of the accident there was pain and an inability to walk properly. Whenever the thigh was flexed this condition was intensified, and in all cases there was a feeling of numbness along the back of the thigh, passing down as far as the knee. The thigh was strapped to limit the movement of the hamstrings as

much as possible and but little walking was allowed. The writer discovered that the cause in the case of each of the jumpers was overstretching of the hamstrings, after the athlete "landed" and made an effort to avoid falling backwards and so spoiling the jump.

In the case of the sprinters - the undergraduates had all been to public schools in London where they had been accustomed to run in flat-heeled sand shoes on asphalte. On their coming to Oxford, where the custom is to run in spikes on a grass or cinder track, a new group of muscles were brought into play. The hamstrings were unduly stretched in the effort to remain on the toes with spiked shoes. The tearing usually took place at starting. He further discovered that if these persons were put into football boots which had heels, the gap in the hamstrings was compensated for and they could run as fast as they had been able to on the grass; but if the heels were again removed the former difficulty once more returned. As to the education and training of different muscles and groups of muscles for the various exercises more will be written in a later chapter. The writer has never seen any account of this particular injury in surgical literature. The treatment is rest, massage, strapping and a raised heel.

Portions of the deltoid and pectoral muscles are occasionally torn from violent muscular efforts. They must be treated by the general principles common to all muscular lacerations viz. rest, strapping, massage

and carefully regulated active as well as passive movements. In the deltoid, wasting is very prone to occur and must be carefully guarded against.

The Rectus abdominis and External Oblique of the abdomen are partially torn in clumsy efforts at rowing, made by the inexperienced and untrained oarsman. In the recovery of the body-swing a jerky action of the recti muscles produces a laceration. It is generally unilateral, and varies as to whether the oarsman rows upon stroke or bow side. The writer has met with a good many cases of partial, but never with a case of complete rupture of the rectus. It is usual to find a fair amount of bruising and extravasation. The treatment most useful is, rest from rowing for a few days, strapping with strips of plaster passing from the pubes to the sternum, and massage twice daily over the plaster. It is a good plan to remove the plaster and to re-apply it every other day, and to massage the skin whenever it is taken off. Then active exercises should be practised with an elastic exerciser for a few days before rowing is resumed.

The external oblique muscle is more frequently injured at rowing than is the rectus, and it may tear either at the digitations or in the conjoined tendon attachments. There is pain when the muscle is put upon the stretch, and often much subcutaneous bruising. Rest, strapping, and daily massage followed by resisting exercises will soon restore its strength.

The tendons may be torn or dislocated. Amongst the most commonly torn may be enumerated the patellar tendon, quadriceps extensor, biceps of arm, tendo achillis, plantaris etc. They may be partially or completely torn, and if the ends are brought into perfect apposition good union will take place. This may be attained by the help of splints and other contrivances, but where there are chances of non-union, as in the instances of the ligamentum patellae and the quadriceps tendon, they should be cut down upon and sutured. In these two cases the knee-joint is nearly always torn open subcutaneously and the synovial joint is full of blood, and in this way the ends are kept widely separated. All the precautions mentioned when writing of suturing the patella will be required here. The ends may be united by catgut or kangaroo tendon. The writer does not recommend wire. He has twice sutured successfully the quadriceps tendon with catgut. After the wounds are healed massage and movements must be systematically employed.

The tendo achillis has been torn by falls upon the heel and in dancing on the toes. There are many cases on record. John Hunter is said to have ruptured his (see Palmer, Life) while dancing when he was aged 39, and to have treated it himself by a roller bandage and with heel raised. It is reported however to have undergone ossification. Probably he

kept it fixed too long, and impaired the nutrition. Although massage was probably well known to him he may not have used it. The writer has only met with one case and it occurred during an effort to mount a "skittish horse" the prognosis in this accident is favourable. Very little pain is experienced sometimes and the union is generally good. The treatment is too well known to require any detailed account here.

Dislocation of tendons.

The most familiar examples are found in the dislocations of the peroneus longus and brevis tendons at the ankle, and of the tibialis positions at the inner side of the ankle-joint. In the former the tendons slip out of their groove behind the external malleolus and come to lie on its outer surface, and in the latter from behind the inner malleolus to lie on its inner surface. (vide photograph, Plate IV)

The mechanism of the injury in each case is so clearly described by Mr. Howard Marsh (Clinical Essays and Lectures 1902), that it is well to quote his remarks. "If, while the foot is either inserted or pointed straight forwards the peroneus longus contracts it cannot slip, for its tendon is drawn tightly into the bottom of the groove at the back of the external malleolus; but when the foot is everted the peroneus has a tendency to leave its groove so that its sheath becomes its pulley, and this, if the strain is severe, may give way".

Monteggia (Istituzioni chirurgiche pt. I. 1820). records the case of a young man who dislocated both the lateral peronei muscles while dancing. They were easily replaced but could not be retained in position; they used to slip in and out without pain.

The writer has seen three cases. In one the peroneus longus alone was displaced, and in the other two cases both muscles (peroneus longus and brevis) were dislodged from their grooves. One of the two latter is now under observation, While dribbling a football the patient overran the ball and stepped on to the top of it. The ball slipping to the left as soon as his weight was put upon it, his foot suddenly came to the ground on its inner edge. The sudden and complete eversion of the foot allowed the tendons to slip from their groove behind the external malleolus. The strain being too great for the fascia bridging over the groove, it gave way and dislocation of both tendons followed. The tendons could be seen lying on the outside of the fibula. The pain was severe, but the patient was soon able to replace the tendons himself with almost instant relief. A good deal of extravasation resulted; walking was possible though painful. The foot was placed in a poro-plaster splint, and kept for four days at a right angle pointing forwards and with a slight tendency to inversion. After this time the splint was daily removed for the application of massage and

passive movements. In ten days the discolouration has all disappeared and active movements were allowed, the foot being held so as to prevent eversion. In four weeks walking was permitted, the massage being kept up.

It may be stated that when the accident occurred the patient was simply running about with the ball in an informal manner, and was wearing light running shoes, not laced football boots.

It is now nearly seven moths since the accident happened, and, though the tendons are in their normal position, any attempt at eversion of the foot produces a feeling of insecurity. Laced boots with the inner side of the sole raised above the level of the outer are worn always to prevent eversion of the foot during ordinary exercise. He has not yet been allowed to play football.

In the case mentioned in which only the single (peroneus longus) tendon was displaced the patient did not come under the writer's care until some weeks after it happened. He was consulted because of an "insecure feeling in the ankle joint" and for a "clicking noise" heard when the foot was everted at will. The tendon in this case was not fixed in its groove, at the time of the first accident, so that no proper repair took place in the sheath, with the result that the tendon now slips forwards at will. It sometimes "gets stuck", and has to be replaced by the fingers of the patient. This chronic condition

causes but slight inconvenience if a high laced boot is worn, or a circular piece of plaster-strapping is applied firmly to the skin above the ankle joint.

It is proposed later if it continues to give trouble to turn up a flap, expose the tendon, replace it, and, if possible, form a new sheath for it by taking a flap of periosteum from the fibula. The record of a case treated successfully by a similar operative procedure has been made.

In recent cases, massage might be used from the very first.

Displacement of the tibialis posticus tendon has been described. "If the foot instead of being everted is inverted, and a strain is thrown upon it, it is the tibialis posticus that is in danger of displacement, for in this position the tendon escapes from its groove and pulls directly upon its sheath". (Howard Marsh, Clinical Essays and Lectures, 1902).

The accompanying photographs show (especially the one with the great toe dorsi-flexed), the tendon of (Fig 2.) the tibialis posticus in a case where it has been displaced from its groove behind the malleolus and is lying on the posterior part of its inner surface.

They were taken from a school-boy who a year ago received the injury. He was playing at Rugby foot-ball, and, while running somewhat in a semicircle to avoid another boy who was trying to tackle him, tried to stop himself suddenly so as to "dodge" his opponent. In doing this he came down upon the outer edge of his

foot (the position of inversion) with all his might. "Something was felt to give" and he had some pain, but was able to run a few paces further. When he was first seen, the tendon had been replaced by one of his masters, but there was much tenderness and extravasation on the inner side of the ankle. Elastic pressure with cotton wool and a bandage was immediately applied. The next day the bandage was removed and gentle massage was commenced. He was kept on the sofa for a fortnight and allowed gently to flex and extend the ankle, but only when the foot was held in the straight position without either inversion or eversion.

All went well for three months when in attempting to run over some hurdles, contrary to advice, he fell awkwardly and produced a recurrence.

He is now able to reproduce the dislocation at will, but suffers no real inconvenience other than being unable to excel at games. A boot with the outer edge of the sole raised to prevent inversion is worn, and, if running is indulged in, a band of adhesive plaster above the ankle to press back and keep the tendon in its proper groove is used. This is the writer's only case. Charles Martins (Bull: de l'Acad: de Med: January 6th. 1874) mentions how he met with a similar accident while ballooning.

The small tendons at the back of the neck are sometimes dislocated, causing the head to be temporarily

fixed in one position. The head may be turned either to the right or to the left. The accident results from a sudden twist of the head as in looking backwards while riding or running. So long as the dislocation exists, movements of the head occasion pain. Reduction is by manipulation. Massage and rubbing are the best treatment.

The long head of the biceps of the arm is sometimes dislocated from its groove by violence, either to the one side or other of its natural bed in the humerus. Limitation of movements at the shoulder and elbow results. It is apt to recur, and the treatment is somewhat unsatisfactory. Made Plate V

INJURIES TO THE NERVOUS SYSTEM.

Concussion of the brain is comparatively common from blows and kicks on the head at football, but falls from horseback etc. are also responsible. The period of unconsciousness varies considerably. In the mildest cases consciousness returns rapidly, sometimes followed by sickness, but frequently unaccompanied by any symptoms save headache and a temporary feeling of giddiness. In the more severe cases the insensibility may continue for some hours. Last year the writer met with such a case. An undergraduate, aged 20, in trying to tackle another, who was running with a football, fell violently upon his head. He lay for a few minutes upon the ground, then arose and resumed his place at "three quarter back". Two or three minutes later he fell down unconscious, and remained in this condition for many hours, from 3. 15. p.m. to 1.30. a.m. As he was thought to have suffered from an inter-cranial haemorrhage, he was watched carefully for any symptoms of compression, and everything was held in readiness for opening his head should this have become necessary. After awaking he was violently sick, and complained of severe frontal headache, which lasted for about 36 hours. The pupils remained somewhat dilated but were quite equal. He seemed to recover rapidly, but on the seventh day after, ~~during~~ by which time he had been allowed to sit up in his room, he suddenly became excited and had

hallucinations of vision and hearing. Shortly after this he became affected with wild delirious mania and required two attendants to manage him. Fortunately this phase passed away as suddenly as it came, and in about 48 hours he appeared to be as quiet and tractable as ever.

The case is described in detail for it presented many unusual characteristics. First there was the mild concussion on the field, followed by a short interval of consciousness with a sudden transition into profound insensibility for many hours. Then came the occurrence of acute mania without any apparent cause, for he had been kept perfectly quiet and not allowed to do any work. The absence of any cerebral irritation was also exceptional. It may be said here that since that attack he has suffered in no way, and is apparently as well as ever he was. Probably the true explanation may be that a slight effusion took place somewhere into the brain, giving rise to mental symptoms, but eventually was completely reabsorbed. Concussions of the brain are fairly common amongst athletes, and should be treated with the greatest possible care.

Injuries to the Spinal Cord may also arise from football. The following history of such a case was written by the patient. "During the course of the game (Rugby), I collided with a player on the opposing side in such a way as to result in his elbow catching me a sharp blow under the chin, and knocking my head

backwards. The blow knocked me over, and for about two minutes I lay on the ground unable to move either arm or leg, and experiencing a sort of numbness in the limbs, though quite conscious all the time of what was going on around me. Then I gradually recovered the use of my limbs, which felt very much like elastic at first. I resumed playing, but had a sort of "pins and needles" in the upper parts of my arms, chiefly along the muscle, and in exactly the same place on each side. I also experienced a pain at the back of my neck as if it was bruised. The symptoms in my arms continued much the same for two days, giving way to a sort of weariness or tired feeling. This however did not last long, but soon died away, though the bruisedlike feeling at the back of my neck continued for some time after. I may still state that I felt in the best of health all the time".

It would appear that the sudden violence applied to the chin forced the head backwards upon the neck at the alto-axoid articulation, and either jarred or bruised the medulla oblongata and upper part of the cord, resulting in an effusion into this particular region. That some such injury must have occurred is evident from the "pins and needles sensation" experienced in the upper extremities, as well as from the weariness in the scapular and upper arm muscles. That it was bilateral proves that the lesion was central. The case ultimately did well. Instances are

recorded where even paraplegia has resulted from a spine injured at football, but fortunately these are rare.

The nerve-trunks themselves, probably from their toughness and strength, are not often permanently damaged; although they are not infrequently rendered temporarily functionless through being pressed upon by effusion, or caught in adhesions, at the sites of fractures and severe sprains. Even actual descending neuritis has been described as occurring in nerves which have been pressed upon by bony callus in cases of fracture. The various abnormal sensations, such as "tingling", "feelings of trickling water" etc., etc., related by patients are obviously the result of a disturbance in the functions of the cutaneous nerves.

Massage and friction will in almost all cases of temporary nerve injury completely restore the function, if systematically and carefully carried out and maintained for some time.

INTERNAL DERANGEMENTS OF THE KNEE JOINT.

Various names have been given to the train of symptoms which for some years have baffled the ingenuity and patience of practitioners. "Displaced semilunar cartilage", "Slipped cartilage", "subluxation" are synonyms. Wm. Hey of Leeds (Practical Observations in Surgery, 1810) makes the first reference to the subject in British surgery. Vincent and Astley Cooper also recorded cases, but no distinction was made during this period between the displacements of the internal and of the external cartilages.

Dr. Scott Lang (Edinburgh Medical Journal 1886-1887, p.516, 718, 790) published an excellent paper on the subject, fully described the anatomy of the condition, and demonstrated clearly the mechanism by which the luxations or semiluxations were brought about. He also distinguished between the two chief forms of displacement, and gave a classification of them. Attention was drawn by him to the importance of the varying development of such structures as the ligamenta alaria, coronary, and transverse ligaments in the knees of different individuals as explanatory of the pre-disposition of some persons, more particularly, to these luxations or internal derangements.

Mr. Herbert Allingham in 1889 published a treatise ("Internal Derangements of the Knee Joint") in which he collected a series of cases including some of his own, in which operations had been performed for the

cure of these conditions. It would appear that the first record of a successful operation was made by Professor Annandale who published an account of his earliest case in the British Medical Journal for April 18th. 1885.

From this time onwards many surgeons have written on the subject.

Several different pathological conditions are now described as giving rise to the so called "internal derangements".

(1) True displacements of the semilunar cartilages.

(2) Portions of thickened synovial membrance which become nipped between the femur and tibia.

(3) Loose bodies in the joint.

(4) Hypertrophied ligamenta alaria.

(5) A bruising of the bases of the semilunar cartilages with effusion around them. (Bennett).

Group (3) may be removed from the present category as it is not truly representative.

Sir Wm. Bennett in a clinical lecture delivered at St. George's Hospital, and reprinted from the "Lancet", January 4th. 1900, gave an analysis of 200 cases.

Of these 182 were males and 18 females.

The ages varied from 13 to 62 years.

Left knee affected in 133 cases, Right in 67.

Inner side seat of symptoms in 155 cases, outer in 45.

98 cases were seen after first attack, 47 after second attack.

All except 20, which were too far advanced, were

treated by temporary rest, massage and exercises, of these 112 were cured, 83 without the use of temporary support or apparatus, 39 had some support.

Operation was performed in 27 cases, all males: of these the semilunar cartilage was at fault in 15 only; of the remaining 12, the causes of the trouble were small pedunculated bodies in 4 cases, and abnormal folds of synovial membrane springing from near the ligamentum patellae in 8. In the 15 cases submitted to operation in which the semilunar cartilage was involved, the left knee was affected in 12 - of other operative cases 7 occurred in the left knee and 5 in the right.

As these are the only full and reliable statistics to hand it was thought advisable to incorporate them here.

During the last fourteen years the present writer has had to deal with 29 cases, - of these 28 were in males, 1 in a female. All the patients were under the age of 30 - the youngest being a boy of 9.

The left knee was affected 18 times, the right 11, including the case of the lady. Of the 29 cases 17 were seen after the first attack, and of the remaining 12, eight represented typical recurrent or relapsing displacement. In other words they were cases which either had been improperly treated or could not be treated successfully without an operation. In two cases the symptoms were bilateral. Of the 17 cases

which were seen after the first attack, all were primarily treated by temporary rest, massage, and early movements; 12 of these recovered without the subsequent use of apparatus and had no relapses; in 5 the symptoms recurred. Apparatus was worn in all these latter, for varying periods, for reasons which will be mentioned later.

The train of symptoms following upon an accident caused by any of the enumerated conditions is so well known that it requires but a passing notice.

The history of some sudden twist in the knee while playing at football, or of "something moving" and causing pain when the individual suddenly attempts to arise after prolonged kneeling, is not infrequent. The limb becomes locked and complete extension impossible. The characteristic position of the limb is slight flexion, or one intermediate between full extension and half way to semiflexion.

Reduction may occur spontaneously, something is felt "to slip back again", relief is experienced, and the leg becomes capable of <u>full</u> extension. At no time is <u>flexion</u> of the joint impossible. In a very short time the joint will begin to fill with fluid, occasionally this occurs immediately. Pain or pressure is usually to be felt over the head of the tuberosity of the tibia along the ~~anterior~~ outer border of the semilunar cartilage. A swelling or irregularity may be felt in this situation, or rarely at the edge of

the cartilage itself. If the cartilage is separated and displaced towards the joint, a slight gap or ~~adhesion~~ depression may be felt between the condyle and head of the tibia.

If the reduction has not been effected when the case is first seen, steps should immediately be taken to bring it about. An anasethetic may or may not be necessary. By placing the patient on his back, and flexing his thigh on to his abdomen to its fullest extent, while the leg is completely flexed upon the thigh, the particular condyle of the femur is removed as much as possible from the head of the tibia. Then extension of the knee should be suddenly and rapidly brought about, and the leg be kept rotated inwards if the internal cartilage is at fault, or outwards in the case of the external. The cartilage will generally slip in, and if this is successfully done the knee is at once capable of complete extension.

It is very unwise to repeat this operation too frequently for in some cases, to be described later, the knee cannot be extended except by gradual means, and only harm will arise from constant attempts.. An anaesthetic is often quite necessary, as a nervous patient or a powerful one may not allow the requisite manipulation.

In recurrent cases patients learn and practise various plans for reduction. Sometimes pressure on the spot will push the cartilage in, at other times

various movements are made, such as placing the heel of the injured limb on the toes of the other foot, and giving a sudden jerk.

One of the writer's patients, an old athlete of great reputation, now a house master of one of the most famous English public schools, told him that whenever his cartilage slips out he goes to the swimming-bath, and generally as soon as he begins to swim, lying prone upon the water and alternately flexing and extending the joint with a certain amount of rotation, reduction takes place.

On two occasions, since this information was given, the writer has successfully followed the plan by placing his patient face downwards upon the floor of his study, and advising him to imitate the movements of swimming. The manoeuvre is worthy of record, and is, to say the least, ingenious and harmless, if not based upon truly scientific principles. When the reduction has taken place the limb should be at once bandaged and the patient made to lie up, The effusion should be treated by elastic pressure with cotton wool and bandaged. No fixed splint is necessary. Passive movements should not be allowed until all the fluid has disappeared (usually in about 8 days) and then only very gradually; beginning with flexion and extension of the toes, then the ankle and muscles of the legs, and lastly the knee. The patella may be passively moved from side to side after the fluid is gone.

Active movements should not be allowed for about a fortnight. By then the cartilage will have had time to become firmly adherent to its original site, and the coronary or transverse ligaments to have reunited. The voluntary movements at first should be only flexion and extension; no rotation should be allowed for at least another week. Walking may be permitted in about three weeks, but must be carried out with the knee kept stiff, by means of a bandage. An elastic knee-cap may be worn later instead of a bandage, but only when the knee is likely to be put upon the strain, as in taking exercise. As soon as exercise is finished, the knee-cap should be removed. Elastic appliances are not satisfactory and should not be worn constantly. If used, they impede the circulation and impair nutrition. From the time that pedal and other active exercises are commenced, usually a fortnight after the injury, and for some weeks later, resisting exercises should be performed by means of weights and pulleys.

It is essential that these exercises should be regularly and systematically carried out. Otherwise, not only wasting of the extensor muscles results, but the muscles which are inserted into the ilio-tibial band (the gluteus maximus and tensor vaginae femoris) will undergo some atrophy and give less support to the fasciae covering the thigh and the knee joint.

If the anatomical relations of these muscles are taken into consideration it becomes obvious that their

influence on the extension of the knee is of the greatest importance. Movements and massage must therefore be thorough; otherwise, a recurrence will take place.

The writer is firmly of opinion that the chief, if not only, way to prevent a recurrence is to develop the muscles of the thigh and buttock, and not to trust to mechanical appliances. As the muscles are exercised and developed, so their tendons and tendinous expansions, which are attached to the capsule of the joint and to the leg, become stronger and support the movements of the knee-joint.

In cases in which recurrence takes place, and in which for some reason an operation is not advisable, the palliative means may be adopted of wearing one of the hinged appliances which have been recommended. These are valuable in so far as they allow the hinge-action of the knee and prevent absolutely any rotation. They may be used while active exercise is taken, but should not, if possible, be worn constantly.

Where relapses are readily produced, as in old standing cases, and where temporary rest, massage, and movements have either failed or been improperly carried out, it may be necessary to remove the cartilage by operation.

Operations on the knee-joint are not to be undertaken lightly, and disasters, not only to limb but to life, occur now and again in the practices of even

eminent surgeons, when every precaution has been taken.

Operations should be reserved for those cases

(1) where all other means of fixing the cartilage have been carefully tried and have failed.

(2) where the disability is in all probability due, not to a displaced cartilage, but to a thickened synovial fringe or hypertrophied ligamenta alaria.

(3) where the diagnosis is doubtful and an exploratory procedure is necessary.

(4) where the capsule becomes so lax and weak that the symptoms are constantly recurring.

The writer has operated on 8 cases:-

In 4 of these the internal semilunar cartilage had been torn from its attachment anteriorly, and in one it had been separated along almost all its circumference; of the other three cases, in 2 the cartilages were intact but the ligamenta alaria were hypertrophied, and in one the right ligament was detached from the femur, and was nipped between the femur and tibia in movements of extension.

In this last case which may be briefly related here, the patient suffered from the symptoms in both knees. He was an undergraduate aged 21. The photographs annexed show the knees before (Plate VI) and after (Plate VII) operation. Any simple action such as the patient rising from his bath, while his knees were semi-flexed, or from the kneeling posture, would cause temporary locking; and as both knees were injured he was quite crippled. He damaged the left knee nearly two years before the

right. He had worn much apparatus and had consulted many persons, eminent and otherwise , before the writer saw him. He had become quite hopelessly depressed about himself and urgently requested that some operation should be performed.

Accordingly, after due preparation, and rest in bed for some days to ensure that no fluid remained in the joint (for this is always advisable) the operation was performed. On opening the left knee by means of a transverse incision over the injury, the internal semilunar cartilage was found to be loose. While attached both anteriorly and posteriorly, it was detached along its circumference as the coronary ligament had been torn across. The synovial membrane was thickened and the ligamentum alarium was prominent. The semilunar cartilage was removed as well as the thickened alar ligament. The joint was flushed out with a hot solution of 1 in 4000 biniodide of mercury to check the oozing, which continued freely after all the visible blood-vessels had been tied. It is most important that no bleeding should take place into the capsule. After a drainage tube had been inserted, the capsule was stitched up carefully, and the wound dressed with an absorbent dry dressing. The limb was then placed in a back splint. The right knee was opened by a similar incision, (see plate VII) and the capsule divided just above the internal cartilage. The cartilage on this side was detached at its anterior border, and lay partially atrophied but adherent to the synovial membrane.

As the ligamenta alaria had the appearance of granulation tissue, the whole mass, cartilage and synovial folds, was clipped away with scissors.

As he had always complained of pain over the external cartilage, an incision was made to examine it. It seemed unusually moveable at its attached border from a stretching of the coronary ligaments, it was therefore stitched firmly into position and not removed. In this patient both internal semilunar cartilages were excised, the right external one was stitched down, and the ligamenta laria in both knees were completely clipped away. The same technique was followed in this knee as in the other. The drainage tube was removed on the right side in 24 hours, but as the left knee was swollen and a little redder its tube was left in position for 48 - at the end of this time both knees were again dressed, and the temperature never rising above 100°F. on the third day and being on the "downward tack", the wounds were left alone till the eighth day when the silkworm-skin-sutures were removed. Catgut was used for the ligatures. All the wounds were completely healed by the eleventh day when massage and passive movements of the patella were commenced, followed by gentle flexion on the fourteenth day, and active movements on the sixteenth ~~day~~. In five weeks he was able to walk and could bend the knees nearly to a right angle, and in eight weeks could do most ordinary things. He ultimately

made a perfect recovery, and is now in India and able not only to ride but to play polo.

The case is interesting for many reasons. In the first place it was exceedingly troublesome and was bi-lateral. When the joints were opened, three different conditions were to be found. (1) A torn detached and partly atrophied internal cartilage (2) Hypertrophied and thickened ligamenta alaria with thickening of the general synovial membrane. (3) An external cartilage partially loose owing to stretching of ~~the~~ the coronary ligaments.

The disfigurement of the scars, (in photograph) is due not to suppuration, but to early movements causing stretching of the new skin. The writer does not now use a transverse incision, nor does he consider the extensive transpatellar incision used by some surgeons necessary. He recommends a vertical incision of about 4 inches, which may be made L shaped if more room is required. The longitudinal incision does not stretch so much and lead to so much disfigurement (vide photograph annexed), and with it the internal lateral ligament is not so likely to be divided.

Sir Wm. Bennett has lately drawn attention to a condition which sometimes exists. In some instances, especially in those where even after manipulation with an anaesthetic complete extension is impossible, he considers the pathological condition to be due to

bruising of the circumference of the semilunar cartilages with haemorrhages around them. The present writer, though never having proved such a condition by operation, believes the explanation given to be a satisfactory one.

He has at the present time a little boy aged 9¼ who has suffered in both knees with symptoms which may be explained by Sir Wm. Bennett's experience. The locking with pain takes place, and complete extension is impracticable for about 5 days after the injury. It is not accompanied by marked effusion into the joint.

The writer is of opinion that in the future fewer cases will be brought to operation, for, if temporary rest, massage, and early movements are properly used, most cases will recover entirely from a first attack.

No treatment diminishes the tendency to recurrence more than systematic muscular exercises, properly carried out for weeks in a gymnasium or with an arrangement of weights and pulleys put up at home.

The use of elastic bandages and fixed apparatus is to be condemned. After reduction the principles of treatment are much the same as those employed for a severe sprain.

SOME REMOTE INJURIES TO JOINTS.

Stiff Joints.

Joints that remain stiff after an athletic injury are not uncommon. Cases of bony ankylosis may be excluded from this category, as they are rarely, if ever, to be met with; for with athletes we have to deal with injuries to healthy joints. Fibrous ankylosis is the form with which the present writer is concerned. Every degree of stiffness may be experienced, from the slightest possible catch in the movements, to complete fixity of the articulation. In the majority of cases stiffness is the result of improper treatment early in the case. Nothing contributes more to the number of cases than the indiscriminate use of splints and fixed apparatus of every kind. A few years ago stiff joints were more common than they are to-day, for practitioners are at last beginning to realise that a joint is not meant to be a rigid structure, and that splinting is more applicable to the union of bones than joints; nevertheless, even at the present time there are not a few who treat joints in this absurd way. Nor is this surprising, for if we consult some of the most recent works on the treatment of sprains and other recent injuries in joints, we find the advice given that absolute rest on a splint, with evaporatory lotions etc., is recommended. The writer can with every confidence state that for fourteen years he has never once used a splint for a recent sprain, nor has

he ever met with a single case in which a fixed appliance was necessary. The first requirement of a joint is complete movement, and to ensure this as soon as possible must be the object of treatment.

When a joint is stiff, there may be adhesion inside the articulation, or the capsule may be rendered stiff and inelastic by adhesions or matting of the tissues immediately around it. The muscles concerned in its movement may have become rigid, either temporarily, or permanently by reason of their physiological shortening.

Granted, that there is stiffness in a particular joint, and the knee joint may be taken as an example, by what means may it be restored to its proper working order?

Forcible manipulation or wrenching has been in vogue for many generations with so-called "bonesetters", whose maxim is to move every joint, whether the case is suitable or not. That many excellent results have followed this rule-of-thumb treatment no surgeon will deny; and although, perhaps, the majority of cases are by these means benefited, there are instances amongst the minority pointing to sheer disaster.

It behoves us therefore to take certain circumstances into consideration whenever it is thought advisable to carry out this plan of treatment.

We must make sure that there is no important complication, or constitutional disease (gout, tuberculosis etc) co-existent, and that bony ankylosis has

been excluded.

When a joint is hot it must be handled with caution. If it is hot and not distended with fluid, tuberculosis is probably the cause. A local rise of temperature, if associated with effusion, will not necessarily bar wrenching, for effusion is often caused by the presence of adhesions in the joint which, on being stretched or torn, give rise to the heat. Effusion without elevated temperature is not a contra-indication.

When the surrounding muscles are much wasted it is probable that the bones are atrophied and week, and a fracture may result from our efforts. When a joint is fairly flaccid, with incomplete stiffness without any heat or effusion, it may be wrenched with impunity.

Stiff joints may be of a purely neurotic type. When a joint is stiff and presents no wasting of the muscles, heat or effusion, the stiffness is probably of nervous origin. Massage should always precede forcible movements. The after-treatment of "wrenching" is of greatest importance. Some surgeons apply a splint immediately to ensure perfect rest. This is not necessary and often does harm. Massage and passive treatment should be commenced early and within 12 hours if possible. Active movements should be enforced, even if they cause pain.

They should not, however, be continued if the joint fills up and becomes tense and hot. Tension without heat is of little or no importance.

Free movements must be continued steadily throughout the first week for it is during this period that the broken-down adhesions are likely to reform, and they will almost certainly do so if the joint is fixed in a splint.

It is a very good rule to give an anaesthetic again within the week, to stretch any new adhesions that may have taken place.

If the breaking down has been incompletely performed at the first operation, a second should be made within a week of the first.

In joints that are not absolutely stiff, i.e. those that are immovable on account of fibrous ankylosis only, the ultimate progress is favourable. Wrenching must be carried out thoroughly, under an anaesthetic, and massage and movements commenced as soon after as possible. A splint should never be applied in uncomplicated cases.

In cases of slight stiffness when pain is the most important symptom, the writer has sometimes found antirheumatic remedies helpful.

Salicine and salicylates taken internally will often relieve the pain in 48 hours, and allow the patient to use a joint freely which for weeks before has been stiff and useless.

While the judicious use of "wrenching" is invaluable to rational treatment, indiscriminate movements must be condemned. Most surgeons will have seen cases where much harm has followed such a plan. The photograph annexed is an instance of bony ankylosis of the knee-joint in a faulty position brought about by wrenching and gymnastic exercises. The subject was a young school-master who twisted his leg at football. For seven weeks it was kept in a plaster splint by the advice of a surgeon and became stiff. He was then persuaded by his friends to see a "bone-setter". This person informed him that he had "slipped a small bone and that he would put it in for him". The joint was wrenched on three occasions and with this result. Some years later the patient wished to become a clergyman and as he could not kneel, he had the leg amputated preferring an artificial joint which allowed of kneeling.

XI.

GENERAL CONSIDERATIONS.

In a former chapter reference was made to the fact that the greater number of injuries were met with by the surgeon among school-boys and young men in the early weeks of either school or University term. Doubtless, this has to do with what is known amongst athletes as "condition". - Very few persons who "go in" for games take the trouble to prepare themselves as carefully as do those who "train for sports". The result is, as pointed out before, that a great many injuries are brought about early in the season.

The muscles and their tendons are perhaps the principal sufferers, but the ligaments receive their share of damage.

Of all the games, football would seem to claim most victims. Perhaps this may be explained by reason of its universal popularity, as well at the Universities and public schools as with the masses of the people in our large manufacturing cities. Other pursuits, such as rowing, contribute the same evidence; for at Oxford during the Winter months when the fresh-men are taken to the river for "tubbing", or in other words to be taught to row in heavy boats, strains and muscualr ruptures occur. More expecially, however, is this the case during the practice for the Eight-oar races ("Torpids") which are rowed early in the spring. The boats used in these Bumping races are heavier than those used in the summer Eight-oar

races or "Eights," and have fixed, not sliding seats. While it is exceedingly rare to meet with sprains in "Eights-men," on the one hand, many are found amongst the "Torpid-men," for while the former are experienced athletes, the latter are not, and in their inexperience and lack of skill move clumsily, exerting their powerful energies in some improper direction. Examples may be related of kindred hurts occurring in almost every athletic calling.

Granted that these injuries arise from inexperience and want of training, they are generally met with in the winter months. The question may be asked, has temperature anything to do with the matter? The writer's reply would ~~perhaps~~ certainly be in the affirmative, for, it is well known that professional runners, especially the sprinters or short-distance runners, are very careful to rub their limbs down with sponges wrung out of warm water before attempting to run a race. From physiological knowledge cold retards muscular contraction, and, as it checks the suppleness of the muscles, it is probable that it may render the tendons and ligaments less elastic and pliable. The muscular vigour remaining the same, under some supreme effort the tissue snaps or tears at its weakest spot, which is generally where the strain is greatest, or where the force of leverage is super-added.

Reference was also made, when dealing previously with ruptures in muscles, to the influence of training particular groups of muscles in school-boy life for

different kinds of exercise from those practised at College. An example was given of the difference between running with sand-shoes on asphalte and running with heel-less spiked shoes on grass or cinders. In the latter case a new group of muscles, requiring proper education in co-ordination, was brought more or less suddenly into play. The result was tearing of the muscles which had to bear unwonted strain, and disaster as far as athletic excellence was concerned.

A rough remedy for utilitarian purposes, viz., the adoption of a heel for running purposes, was mentioned as having been found helpful. These are make-shift remedies however, and the scientific and proper treatment lies in a regular and gradual muscular training in all athletic performances. The old maxim, "prevention is better than cure", was never more applicable.

This leads us to the substitution of exercises for meeting various injuries. By this is meant, that while an athlete may sometimes be quite incapacitated from taking part in a particular game, or form of exercise, by reason of his suffering from defect caused by injury to muscles or a joint, he may be able to "go in for" some other form of exercise, and, not only excel in it, but at the same time carry out the very exercise which is helpful for or even curative of his old injury.

Such an example the writer would place on record

from his own experience and experiment. Several of his patients who had suffered from "internal derangements" of the knee, and who had been treated for this condition, while they dared not play at football for fear of recurrence (for no game is more productive of this disability) were ~~quite~~ able to row. In two cases in which recurrence had previously taken place in more than one occasion, at football, rowing was perfectly safe. The muscles of the thigh and buttock are in rowing enormously developed, and as in Eight-oar races the training is gradual and spreads over a prolonged time, the muscles in developing strengthen their tendons around the joint, and cure results. The writer was first led to try this experiment, arguing from the success which followed upon the pulling and resisting exercises practised in some of the gynasiums adapted for all such purposes. The movement at the knees in rowing is chiefly that of a hinge. The feet are fixed by straps into the stretchers with the toes turned outwards, an important position for our present purpose. It may be stated however that all the cases so far treated in this way (about 10 or 12) have been seen where the internal cartilage, or the coronary ligaments and ligamenta alaria were suspected. It remains to be proved whether cases of subluxation of the external semilunar cartilage will be cured in this way.

Again, where the ham-strings were torn in running

and jumping, while excellence was a thing of the past in these pursuits, in several cases, by the aid of a heel to make up the deficiency, football has been not only feasible but played with success.

Much could be said about the system of dieting for athletic training, but time will not permit in this thesis. The enormous breakfasts of meat, (beef-steaks, chops) eggs, preserves etc. etc., that used to be consumed by the rowing man are fortunately rapidly becoming things of the past. Nevertheless, tradition still holds a firm grasp upon the life at the Old Universities, be it in college-quad, class-room, or athletic park.

A word or two more in relation to "keeping and being fit," No muscle in the body is second in its efforts to the heart in maintaining excellence in athletic performances, yet how often is this organ not considered! The essential to being in the "pink of condition" is a gradual and successful development of the heart as a muscle. And this must be so. The writer ventures to suggest that no form of training will be lasting or successful which does not consider the gradual development of the heart.

Now the heart may be dilated or hypertrophied. The latter condition to a greater or less degree is always the result of training and, if not overdone, will not be particularly harmful. It is the consequence, when excessive, of too much work sustained for too long a time, as in the case of scullers and

rowers.

The former, dilatation of the heart, generally arises as a strain from the athlete doing too suddenly his maximum amount of work, or striving to attain this too quickly.

He starts not improbably out of condition and thinks that, by taking violent exercise, he will quickly fall into line with his colleagues and friends. What happens, supposing he is anaemic? The muscles of his body for this reason are improperly nourished, for the blood does not contain a sufficiency of red colouring matter necessary for carrying enough oxygen to the tissues. "Internal Respiration" fails, and "instead of becoming harder he finds himself with a slight cough, sleeping and eating badly, and becoming sick of his work". Such a picture is not infrequently to be seen at Oxford, purely as a result of a dilated heart, previously caused through ignorance of the most elementary principles of physiology, combined with a worship of the fetish of college tradition.

Such a man's athletic future is of doubtful value. Excellence will rarely accure, for it takes many weeks of enforced rest, unless the heart has been treated early, so as to allow him to recuperate sufficiently to run his race with credit to himself and to his college.

In cases of dilated heart and overstraining, arsenic

given in small doses combined with the phosphates is a very valuable frug. It tones up the tissues and in a very few days gives a feeling of well-being. Its use should be continued for some weeks unless it disagrees with digestion.

This may be assisted by the system of resisting exercises similar to those practised at Nauheim.

What is known is athletic parlance as "second-wind" is probably due more to cardiae than pulmonary influence. Cardiae hypertrophy with its accompanying symptoms is likely to follow from too much rowing and long distance running if maintained for any length of time.

Dilatation more frequently occurs from football scrummaging or sprinting - Each may however result from almost any form of exercise if proper care is not taken to get into training gradually. For hypertrophy, limitation of violent exercise is the first essential to successful treatment, without it, all other means will be futile. There seems to be little doubt but that athletic injuries are more frequent during the winter months. The habit of wearing the most scanty apparel, a system so much in vogue at the Universities, must act as a perdisposing cause; yet, it is difficult to suggest a remedy or to devise more suitable means.

More might be written in favour of a more rational system of training but space will not permit.

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Description of Plates

PLATE I.

Photos of a macerated ilium of person aged 16 showing the epiphysis for the anterior inferior spinous process, as yet unossified. Ossification usually takes place at 19.

PLATE II.

Photo from a case in which the patella had been fractured and was united by means of catgut sutures, to show central longitudinal incision and lateral one for drainage as described in text. Four weeks after operation.

PLATE III. p 51.

Photo showing old rupture of rectus femoris muscle - also longitudinal incision for removal of internal semilunar cartilage of knee - some weeks after operation.

PLATE IV. p 58.

Photos, to indicate position of the tibialis posticus tendon. In figure I. the tendon is behind the edge of the internal malleolus:- in fig: II. it is displaced forwards and lies on the bone.

PLATE V. p 63.

A drawing after Poirrier to show position of the long head of biceps which is sometimes displaced from its groove in the humerus.

PLATE VI. p 76.

Photo of knees of patient before operation, in whom the semilunar cartilages were constantly being displaced. It shows well the chronic thickening of the synovial pouch and distension of the capsule.

PLATE VII. p 76.

Photos of the knees after operation. Showing transome incisions. (The writer's earlier plan).

PLATE VIII.

A drawing of dissected and flexed knee joint to show relative positions of the semilunar cartilages and transome ligament.

PLATE IX.

Drawing of section through knee joint showing well the position of the infra-patellar pad, and synovial pouches etc.

PLATE X.

Photos demonstrating the evil results which may result from indiscriminate active movement in a joint in which the semilunar cartilage had been displaced.

PLATES XI, XII, XIII.

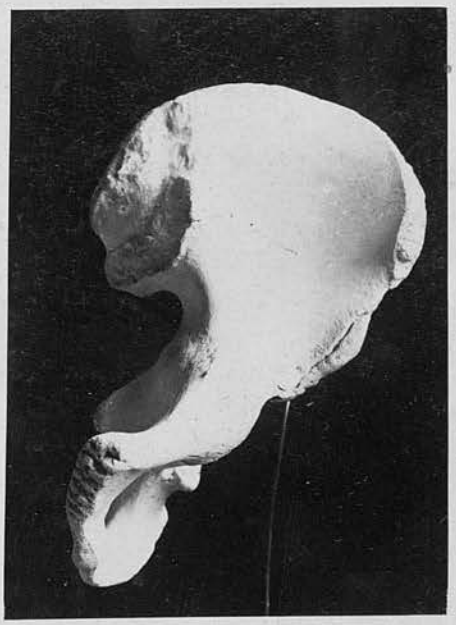
Are drawings of the thigh dissected to demonstrate the muscles, and in XIII more specially the insertions

of the Gluteus maximus and tensor vaginae femoris into the leg through the ilio-tibial-band (after Poirrier).

PLATE XIV.

A drawing of section through the shoulder joint showing relative position of the parts. Especially of the large sub-deltoid bursa.

Plate 1. p. 41



Part of Thesis for the degree of M.D. in the University of Edinburgh. by Richard Henry Asplin Whitelocke M.B.C.M. April 1903

Illustrations of cases alluded to in the text.

Plate II p 44-47

Plate III p 51

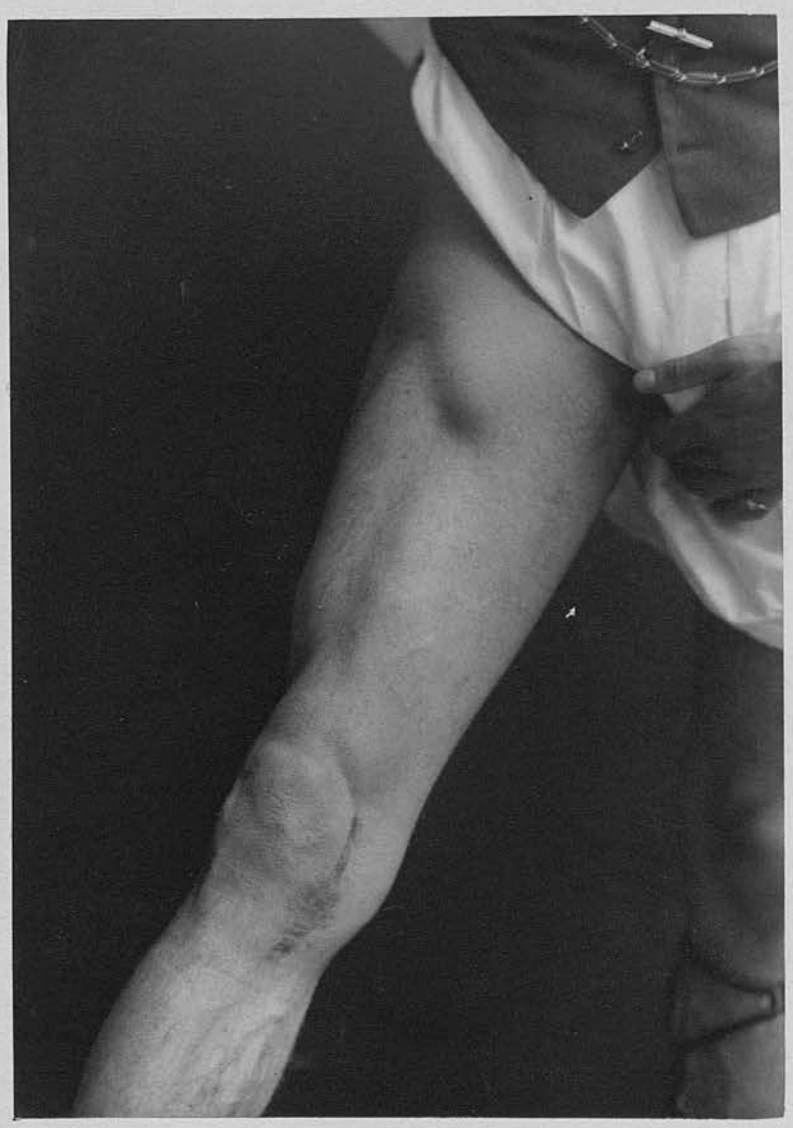
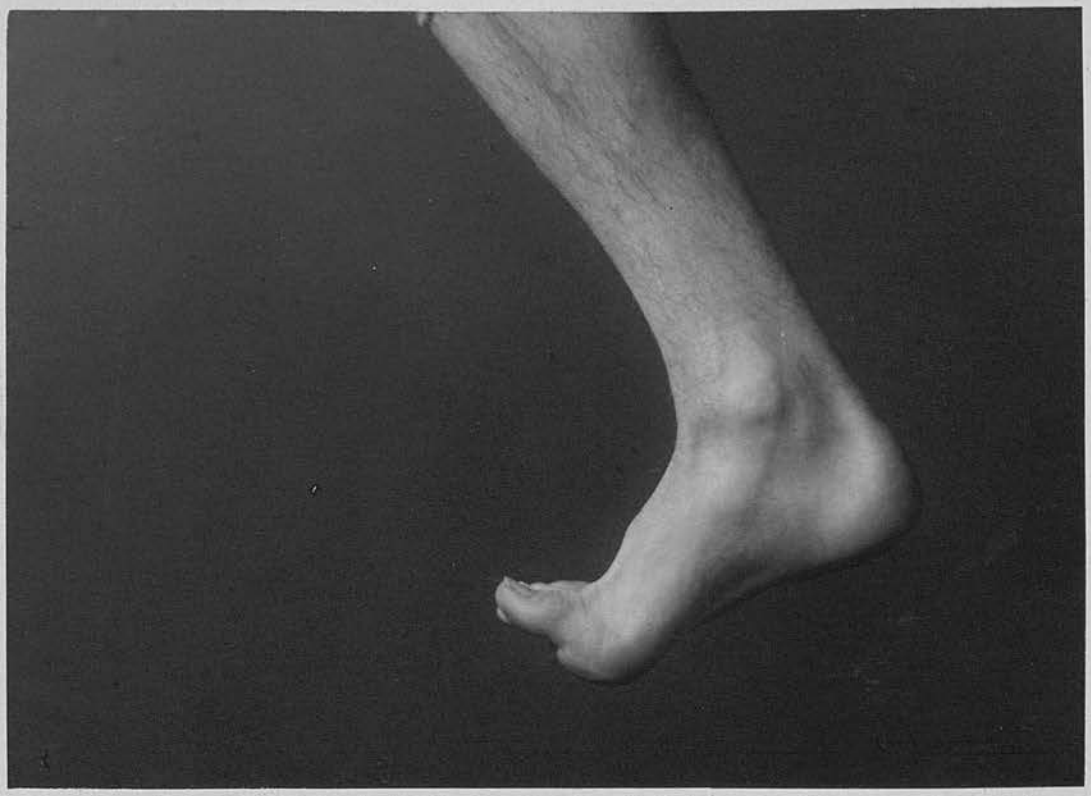


Plate IV p 58.

Figure 1 tendon (P. tibialis) in position
Figure 2 " " " " displaced forwards



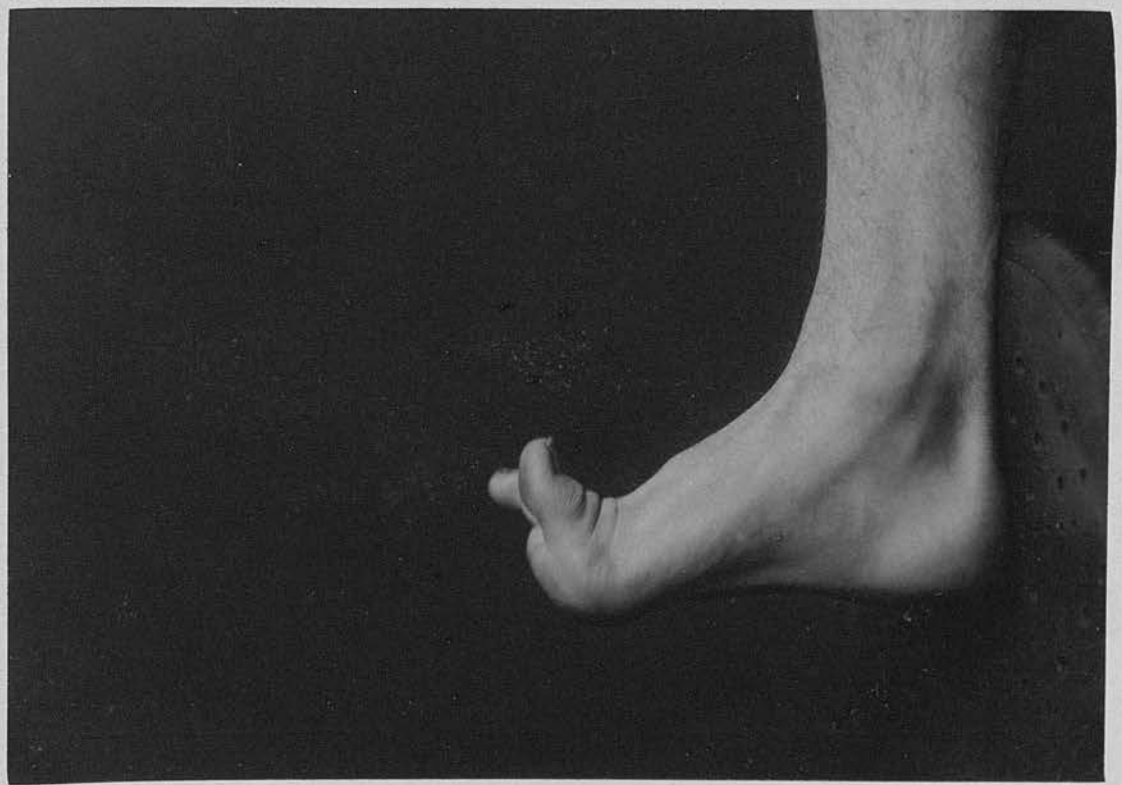


Plate V p 63

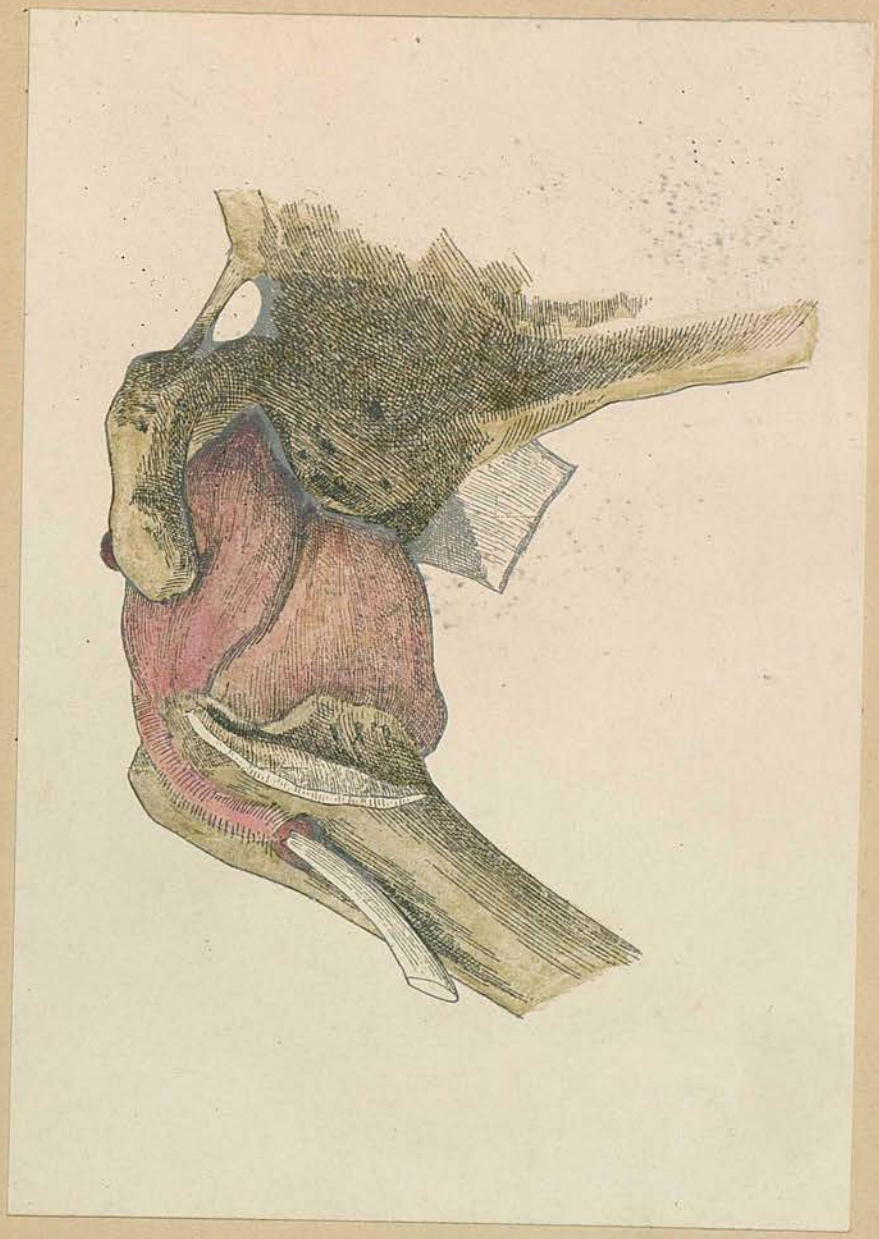


Plate VI p 76

Plate VII p 76

Plate VIII

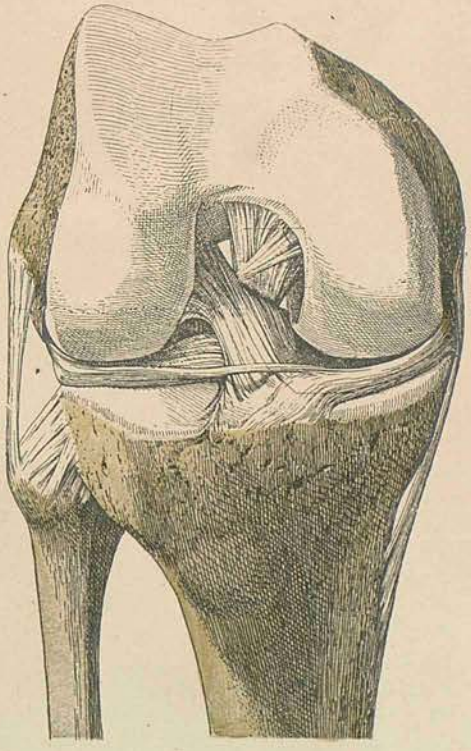


Plate IX

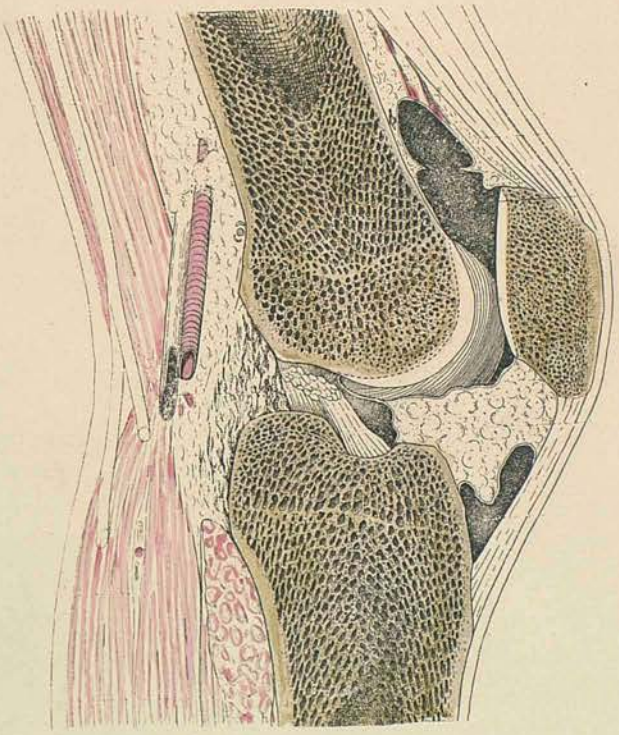


Plate X

a

b

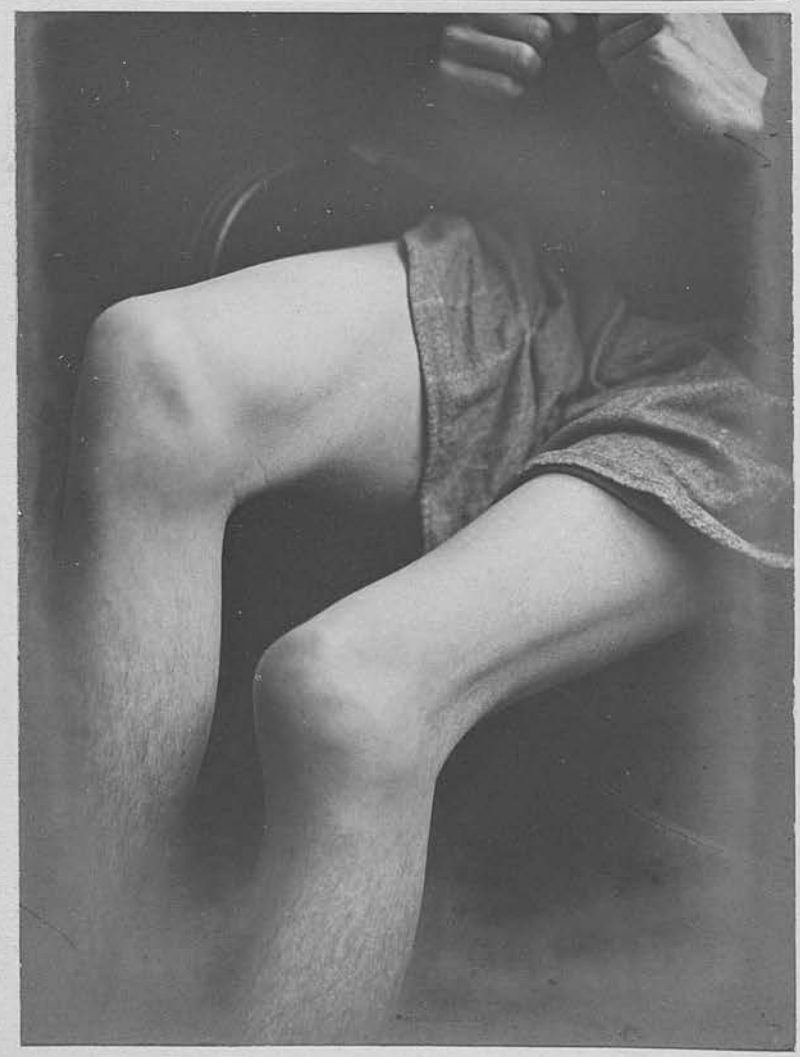


Plate XI

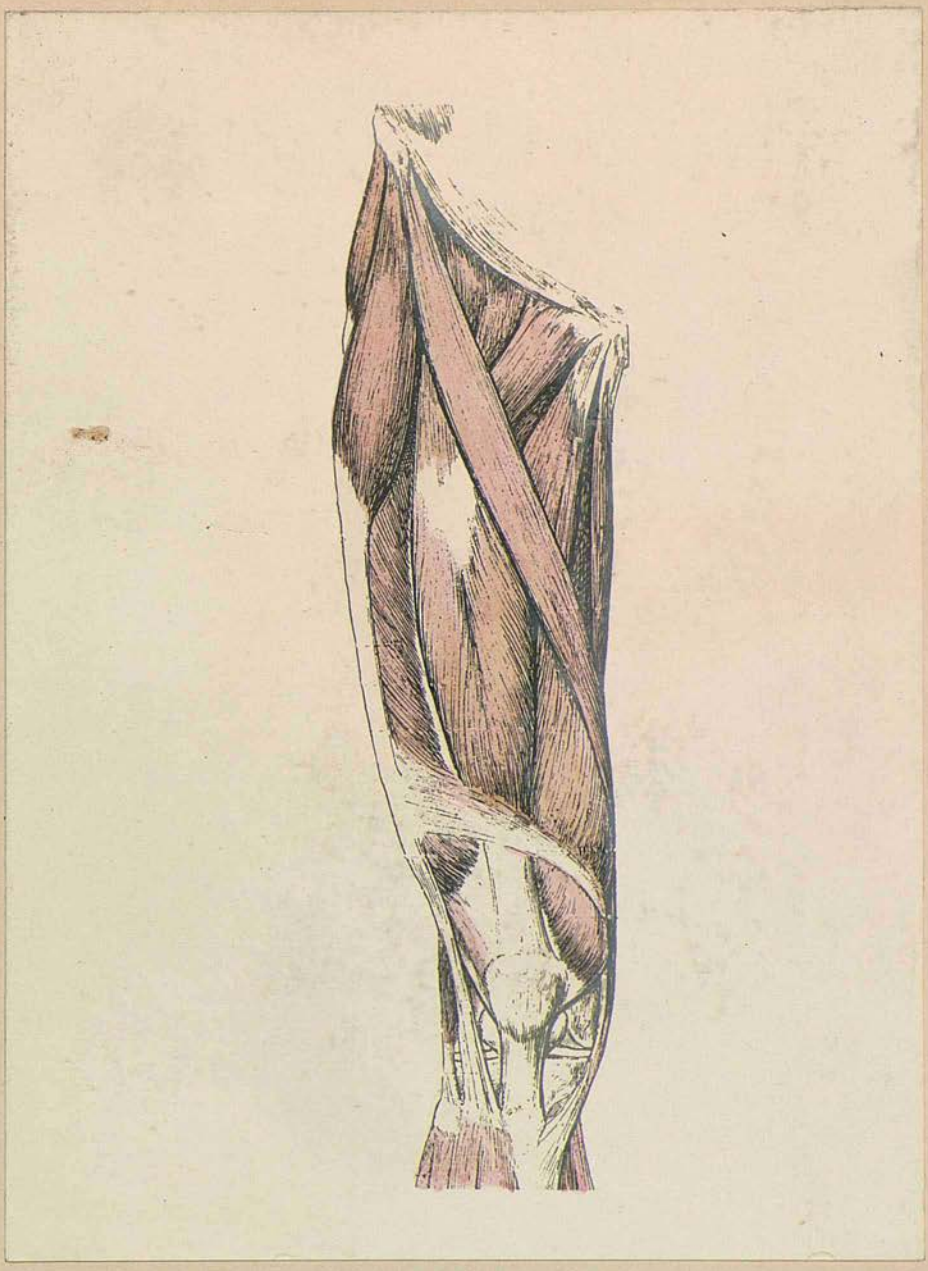


Plate XII

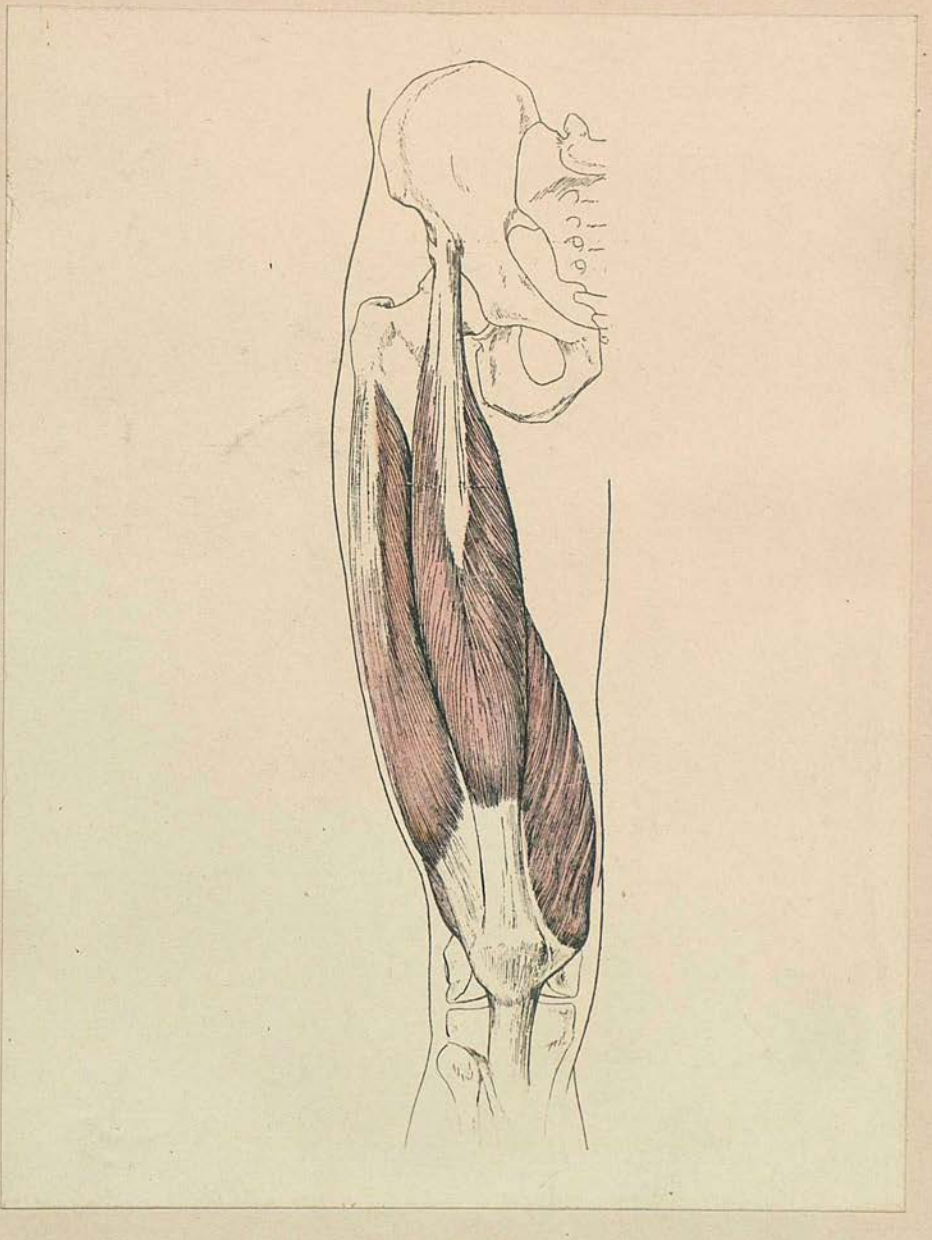


Plate XIII

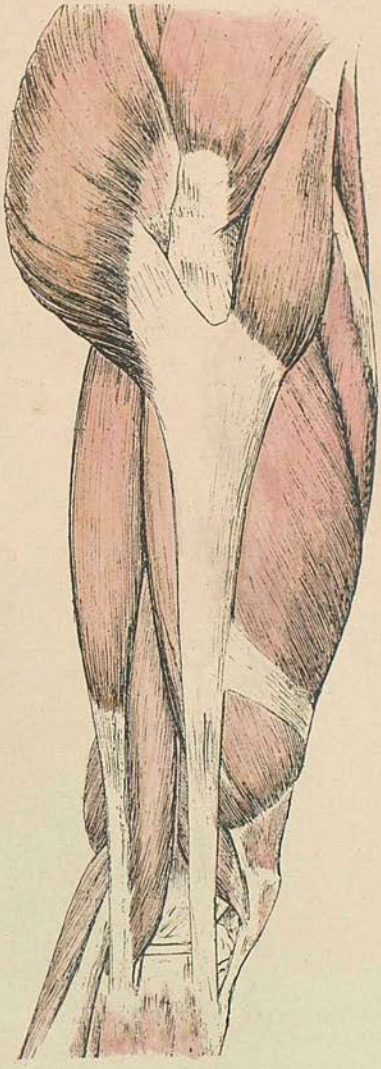


Plate XIV